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AUSTRALIAN COAST DEFENCES.

Some time since, the Government of Great Britain withdrew the troops which were usually kept doing a kind of garrison duty in the colonies, and left the colonial administrations to defend themselves from any sudden attack, of course holding itself in readiness to dispatch ships and regiments to any place as soon as the news of intended or actual hostilities reached a military or naval station. The Australasian colonies have, therefore, constructed floating batteries and men-of-war for harbor and coast defence, which are, for the most part, manned by volunteers.

We publish herewith an engraving of a powerful ironclad, the Cerberus, belonging to the colony of Victoria. She cruises around the mouth of Port Philip Bay, and is powerfully armed, carrying four heavy guns throwing shot weighing 400 lbs. each. The guns are erected in two bomb proof revolving turrets; and the deck of the ship, when she is ready for action, is only about 26 inches above her water line, the vessel then drawing about 16 feet 6 inches of water. An additional revolving turret, carrying 1 gun, is placed in her bow, and a similar one in her stern. She is propelled by twin screws with four blades each, driven by powerful engines.

The Peabody Dwelling Houses in London.

According to the London *Daily News*, there are now ten blocks of improved dwellings for the poor of London, to testify of the wisdom and generosity of George Peabody. The last, still in the course of erection, promises to be the largest of all, for it stands on five acres of ground and numbers thirty-six blocks, twelve already far advanced.

Of the completed congeries of homes already opened, the latest is in Southwark street. It is a substantial building of twelve blocks, and, taking the average of four in each family, will supply house room for about one thousand persons. In each block there are twenty-two tenements, a few consisting of one room, some of two, and many of three, but each absolutely self-contained, and all as private as if they were flats in Victoria street, or in the Rue du Faubourg St. Honoré. The three room tenements consist—to take an average example—of a kitchen 15 feet by 12, a bedroom 16 feet by 14, and a second bedroom 12 feet by 16 The floors are boarded over, the walls are cemented, and all are at present beautifully white. There is a fireplace in each room, that in the kitchen being furnished with a capital oven and boiler. There are several cupboards, one in the kitchen having over it a meat safe, with doors of perforated zinc. In the passage outside is a coal bin of neat and ingenious construction, capable of holding half a ton. On each flat there is a laundry, with copper boiler, a wringing machine, and mangle. This is devoted to the use of four families, who have the privilege of occupying it by turns one day a week. Each flat has a dust shoot, the tenants having no further trouble than to open it and drop down the contents of their shovels. Nor does this conclude the list of special accommodations in these wonderful mansions. In an underground room of each tenement there is a capacious bath, to which the tenants have access without charge, and as often as they please, there being no other necessary preliminary than that of calling at the superintendent's office for the key. Gas is provided in the wash houses and through the roomy staircases, also at the expense of the trustees. The rent of a three-roomed tenement is $1 38 a week; for two rooms, $1.08, and for one room, 72c.

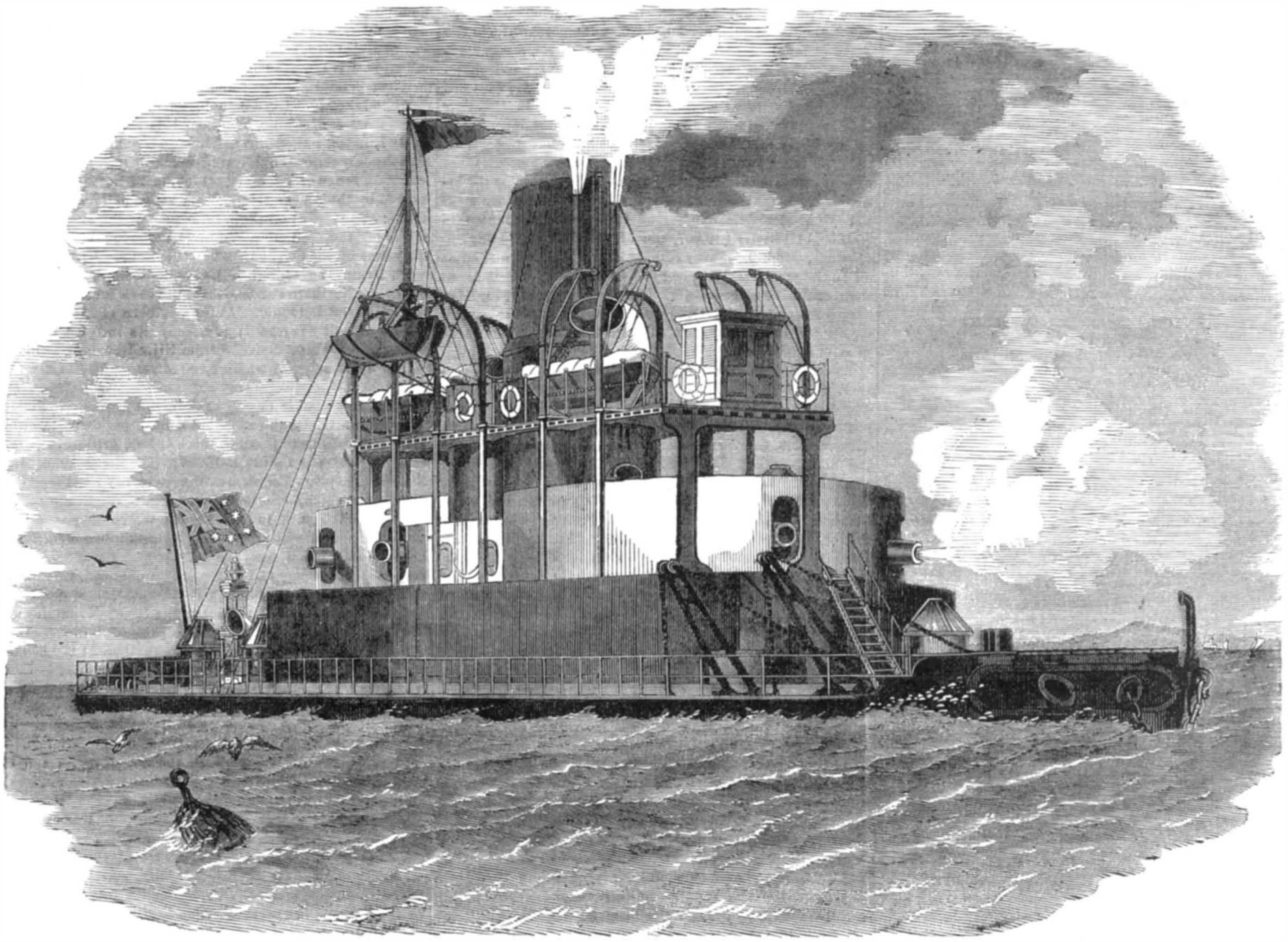
A striking feature of the management of these dwellings is the absence of arbitrary interference with the liberty of the tenants, the few simple rules enforced looking simply to the order, cleanliness, and general good of the community. Rents are insisted on weekly in advance, and the houses are always full. The tenants are strictly of the laboring classes, it being an unprinted rule of the place that no man earning more than $5, or at most $6 a week, is eligible for admission. Nothing else is required of an incoming tenant further than a voucher of his respectability, generally sought at the hands of his employer; and other things being equal, the superintendent makes a practice of giving the preference to families where the bread winner is engaged at a distance not too remote to prevent his returning home to take his dinner with his family.

In the aggregate, the population of the Peabody buildings is already not less than ten thousand persons. As the buildings pay a small interest on the money invested, and there is besides the interest on $2,500,000 to be used in the erection of new buildings of the sort, their increase of capacity is almost limitless.

The Sardine Trade-- A New Utilization of the Grasshoppers.

Itt is officially reported by the French Minister of Marine that the sardine fisheries are gradually diminishing in yield. The reason is not that the fish are becoming scarce, but that the supply of bait used, the roe of the codfish imported from American fisheries, has become inadequate to meet the demand. It has lately been found, however, that grasshoppers, pounded into a paste, imitate the roe so exactly that the most knowing of the sardines cannot distinguish the difference; and accordingly the French government has imported large quantities of the insects from Algeria in order to try the new bait on a large scale. This fact of the grasshoppers being good for fish bait might be looked into somewhat further here, and it may appear that the insects which yearly ravage our western country, may be turned to good account for catching fish indigenous to our waters.

It is interesting to learn, *apropos* of sardines, that the United States is the largest consumer of the fish, which are exported, as is well known, in tin cans packed in oil; but on the other hand, it has been discovered that fully 40 per cent of the fish which we buy as sardines are not genuine, but are young



AN AUSTRALIAN MAN-OF-WAR

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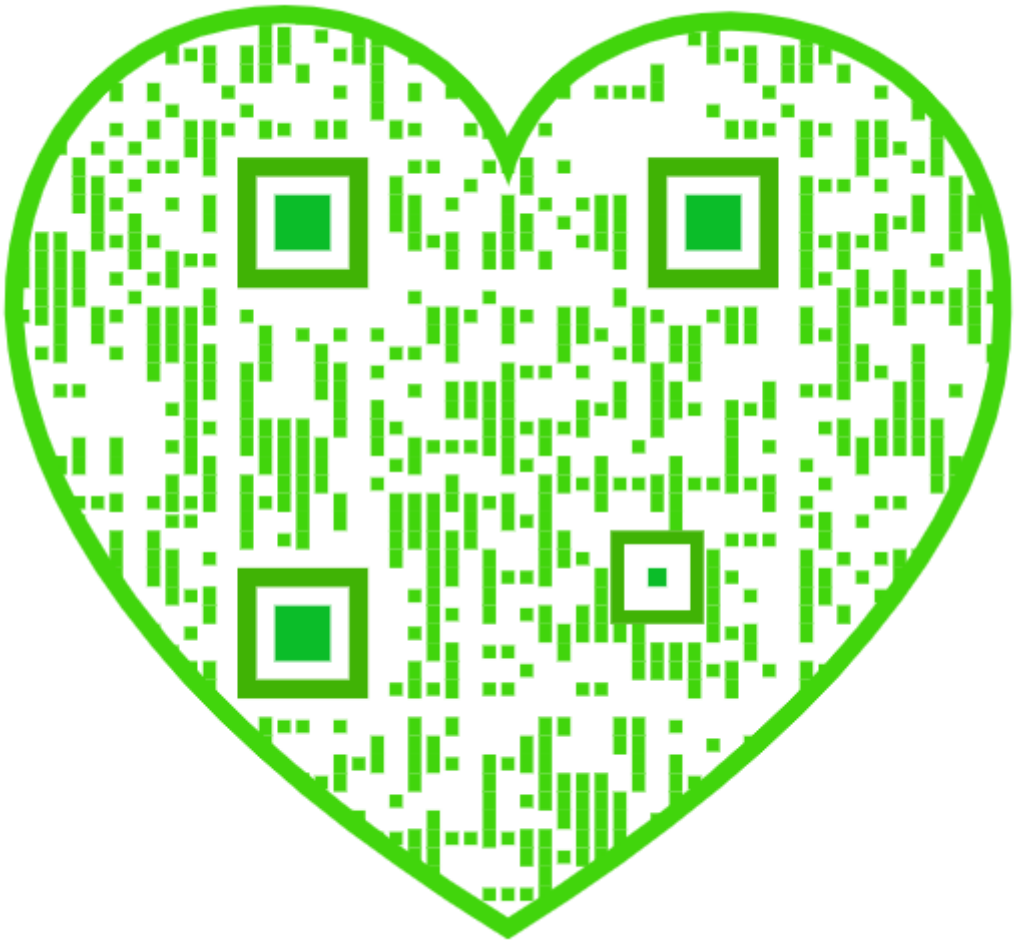

sprats, mackerel, and other common species. A syndicate has lately been established in France to watch exports in the future, and prevent the sale of such fish as are not genuine and of marketable quality. The ordinary yearly production of sardines in France now reaches 500,000 cases.

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INDUSTRIAL ART.—SOME THOUGHTS FOR THE CENTENNIAL.

A correspondent, referring to our recent editorial on what working men might contribute to the Centennial, in which we deprecated nickel or silver plating on handmade metal articles, and suggested file, polishing as a more workmanlike finish, asks whether we are not opposed to ornamentation of machinery or tools, and whether we do not think that artistic design is superfluous in implements or materials meant for "solid work." To this, we reply emphatically in the negative; and we have a few remarks to offer relating to the subject, which may be timely in their bearing upon the approaching exposition of our industries. It may be laid down as an unfailing rule that, when any person is given the choice of two articles, identical in every respect save that of grace of form or beauty of decoration, the handsomer will certainly be selected. This appears to be a simple enough proposition; but when it comes to be applied to great classes of manufactured products, those who make the latter seem to forget it, or at most to accord to it but very little attention. The majority of mankind even go further in their predilection for the tasteful, and in nine cases out of ten will prefer an inferior article of beautiful design, to a really superior object of homelier appearance, the gain in beauty compensating for the lack of usefulness. Several times a year dry goods dealers heap their counters with fabrics of elegant patterns; out of a variety of styles perhaps half a dozen may be "the rage," simply because of their beauty. As a result the resources of the manufacturer are taxed to the utmost to produce the particular kinds of goods demanded, and both manufacturer and dealer gain large profits on the favored fabrics. And yet these very goods may be identical, in every thing but dye or mere pattern, with whole bales of material which the dealer can scarcely get rid of at any price. The same is true of carpets, of wall paper, of crockery and glassware, of any of the varied products into which artistic design may enter. People will pay for beauty, pay for it on a scale which cannot be measured by any standard. They may examine their purchases for other qualities never so closely, may gage durability or strength or efficiency or internal composition to hairbreadth accuracy; but artistic finish and tasteful form defy us to judge how much money is commensurable with a given amount of elegance.

Not long ago a very wealthy merchant of this city paid $60,000 for a single painting about four feet in length by less than 3 feet in hight. From a purely utilitarian point of view, the picture was a mere bit of painted canvas, useless even as a fire screen; from an æsthetic standpoint it represented a fortune. The same merchant lately paid $9,000 for a block of marble. As a hitching post, that block would have been worth its cartage to the place where it was needed; as a sculptor's masterpiece, possessing exquisite beauty, its value exceeded even the large sum paid for it. We can proceed a step further, and glance at the amounts which, as a nation, we pay out for mere beauty. During the three months ending September 30, 1875, we imported $1,749,655 worth of fancy goods, such as Vienna trinkets, Swiss carvings, etc., $310,429 worth of paintings, statuary, and photographic pictures; and to this perhaps should be added $181,665 worth of jewelry and precious metal work. In the year 1875, we imported fancy goods worth $6,005,940, figures indicating nearly threefold the value of the similar imports of 1865. So much for the beauty we buy of other nations. Let us now compare these figures with those representing the artistic articles that we sell. For the three months above mentioned our domestic exports of fancy goods amounted to $90,250, of jewelry $19,307, and of paintings, including engravings, $46,079. Fancy articles we do not find quoted at all on the yearly tables; nor have we any such industry as their exclusive manufacture. For the quarter of 1875, however, we imported $2,241,759 worth of articles valuable principally for their beauty, and exported the same to the value of only $155,636.

To carry out our examination of this subject still further, we give here a list of the numbers of all persons engaged in artistic pursuits or callings which have for their end the decoration of raw products. There are 775 painters, 250 sculptors, and 2,948 general artists, 108 teachers of drawing and painting, 2,017 architects, 1,169 artificial flower makers, 208 bone and ivory workers, 79 bronze workers, 7,558 photographers, 4,226 engravers, 569 galloon and tassel makers, 1,534 gilders, 18,508 gold and silver workers, 970 mirror and picture frame makers, 85,123 painters and varnishers, and 223 plaster molders. Total 126,265. This aggregate is a little larger than that of all the teamsters and dairymen in the country; it is very much less than that of the blacksmiths, and it about equals that of the teachers. In fact, adding together the number of teachers who educate us, and the aggregate of those whose labor involves our artistic culture and refinement, we have a sum which just about equals the total number of tailors and milliners, and is 40,000 less than the total number of clerks.

Abundant evidence, similar to the above, can easily be adduced, first, to show that we import a very much larger quantity of artistic productions than we export, and that but a very small portion of our population is devoted to pursuits of an artistic or semi-artistic nature. What is true of individuals is equally true of nations. France, pre-eminent as the designer of beautiful wares, buys of us $50,000,000 worth of iron, and machinery, and provisions, and sends us $63,000,000 worth of articles, most of which find their way to the stores of the jewelers, the china dealers, and the picture sellers. Italy sends us $2,000,000 worth of art work in excess of the $7,000,000 in staples which we send to her shores. With the exception of these two countries, which for ages have led the world in tasteful and artistic productions, our exports to every other European nation are far in excess of our imports.

In face of all this, it is difficult for any one to see how the country can be otherwise than benefited by the fostering of art culture to its full extent among our workmen. The old world is tributary to us for rough and raw products, and for new means of manufacturing them. We are tributary to the old world for the means of gratifying artistic tastes which cultivate and refine. Let us develope the artistic ability which lies in us, and we are tributary no longer. Let us make our manufactured productions as elegant in shape, as graceful in design, as those of France, and then, and not until then, will we enter in fair competition with that country or any other artistic nation in foreign markets. Nor should we imitate. Copying is but servile work; originality in design the world seeks, praises, and pays for.

The above views we commend to the careful consideration of exhibitors at the Centennial. Many people, we have heard, propose showing machines taken straight from stock without further embellishment or ornamentation; others intend to send samples of their goods irrespective of pattern or design, trusting in the intrinsic excellence of the articles to secure notice and future custom. We think this is a mistake. It costs little to ornament a machine tastefully, and discrimination in selecting the handsomest patterns is easily exercised. The advantage gained will, in a collection of such entries, be twofold: first, we will show the world that we are able to produce tasteful and artistic designs, and, second, we shall have prepared a collection of models of industrial art which will be of the greatest value as an educator and in exciting the emulation of our own people.

A RAILROAD ACROSS THE EASTERN CONTINENT.

The great feat accomplished by the United States in connecting the Atlantic and Pacific Oceans, by a railroad across the United States, is stimulating enterprise in Europe; and it is now proposed—indeed the plan is matured—to connect the Atlantic and Pacific Oceans by a railroad through Central Asia. At a conference of the geographers recently held, Colonel Bogdanowitz explained some of the details of the road, which, it is expected, will overcome one of the great obstacles to the extension of civilization, namely, the separation of a large part of Asia from Europe by vast deserts, in which no means of transit but a railroad could be of any use. A railroad alone can develop the resources of the many lands through which it would pass; and as the mineral wealth of Siberia and the Ural Mountains is well known, the exploration and mining of these regions would be encouraged, and their resources developed.

It is proposed that the road shall start from Nijni-Novgorod, in Russia, where is now the extreme eastern station in the network of European railroads; it will run along the Volga to Kazan, then up the tributary of the Volga, the Kama, to Ekaterinbourg, on the Asiatic side of the Ural Mountains, then enter Asia, proceed in the direction of Troumen and Omsk at the Irtish, cross that river, and proceed by way of Kainsk to Tomsk on the Tom, a branch of the Obi, and cross that river. Tomsk is the principal center of commerce of Western Siberia; and thence the road will run directly to Irkutsh at Lake Baikal. Thence the road is to pass to the frontier of China, and then it is no longer an exclusively Russian, but an international undertaking. And here, also, the only serious engineering difficulties commence, at the mountain range of Kinghan, which, in its northern part, is crossed by the Amoor river. This range is the greatest obstacle; and it will be necessary to pass by the Mautchooria, and to lay the road from Baikal to Verhnéoudinsk through the valley of the Selenga. Then the best route by which to reach Pekin, the capital of China, near the Yellow Sea (a bay of the Northern Pacific Ocean) has been found to be that of Tchita and Dolounor. At the southern end, the famous great wall will be crossed; it already lies in ruins in many places. The whole distance from Nijni-Novgorod to Pekin will be 4,500 miles, of which 3,800 run through Russian territory.

When this plan is closely examined, according to known topographical data, the apparent difficulties dwindle down to nothing when compared to those encountered in the western section of our Pacific Railroad. The first section, from Nijni-Novgorod to Tomsk, runs on perfectly level land (the so-called steppes), similar to our prairies. In the second section, from Tomsk to Lake Baikal, the country is rolling, and interspersed with rivers and streams: but the greatest hight is only 3,500 feet, and the largest rivers are but of very moderate width and depth. The only serious difficulties, as we have said, lie at the Chinese frontier, and they are inferior to those overcome in the Rocky Mountains and the Sierra Nevada by the American engineers.

Russia has raised in 15 years more than $1,000,000,000 with which to construct 15,000 miles of railroad, and can easily find $300,000,000 or $400,000,000 to construct a line of such value to all the civilized world.

THE EDUCATION OF CROWS.

In the battle of wits between the gamekeepers and the crows of Germany, the latter are said to have acquired the ability to count as high as six—rather more than some tribes of human savages, if travelers' tales are to be trusted.

To protect the young broods of pheasants, the gamekeepers wage unsparing war against the crows, which have consequently become exceedingly wary and good judges of the range of ordinary guns. Various stratagems are resorted to by the keepers, one of them being to erect shelters near the gathering places of the crows, from which to shoot them when they unwittingly approach. The crows suspiciously keep aloof except when they are sure of safety; but the

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moment the keeper departs, they flock to their posts of observation with provoking assurance. It is found that the keepers must go to the cover in parties of six or more, then depart one by one until six have left, leaving one or more behind to take vengeance on the crows. Should a less number than six visit the shelter, and all but one leave it, the crows perform the subtraction correctly, and know that there is yet no safety for them. Beyond six, their mathematical faculty fails—or did some years ago: perhaps they have learned to count more by this time.

It seems that the crows of Maine are only half as highly educated. A farmer in that State, exasperated by the depredation of crows among his sprouting corn, lay in wait for them often and long, but without success. Then he tried the German stratagem. He took his son with him to a shanty in the field, and shortly after sent him away; the hungry birds patiently waited until the farmer also departed, then they helped themselves. The next day he took two persons with him with the same result; first one person left the field, then another, the crows cawing their approval, but remaining in their safe position; and not until the third person had been seen to depart from the field would the cunning creatures trust themselves within gunshot of the little building. The next day, half a dozen entered it. Presently one of them went back across the field. The crows mentioned the fact among themselves, but kept their distance, among the trees. Another person went away, with the same result. Directly a third emerged from the building and disappeared, the unhappy crows, having reached the end of their mathematical rope, came down in platoons to their deferred breakfast, unaware of the three armed enemies still remaining in the building, who at once opened fire upon the poor birds, whose great misfortune was that they were unable to count more than three.

A gentleman writing to the Portland *Advertiser* says that this experiment was tried repeatedly, but the crows invariably lost their reckoning when the number exceeded three.

Evidently the education of the crows of Maine has been neglected. It would be an interesting experiment to repeat the process of deception to see how long it would take them to count four, or more.

THE CENTENNIAL BILL PASSED.

The bill appropriating $1,500,000 for the purposes of the Centennial Exposition has become a law. It passed the Senate by a vote of 40 to 15, and was soon after signed by the President with the plume of an American eagle, which some patriotic individual provided for the occasion. The accession to the Centennial funds prevents, it is said, the accumulation of any debts for the completion of the buildings and grounds. The act which grants the money is coupled with a stipulation that the sum shall be repaid into the United States Treasury, without interest, out of any profits which may remain after the subscribers to the capital stock shall have been reimbursed. This is of course a contingency which may or may not happen; but in any event the stipulation is a favorable one, and will tend greatly to appease the large number of people who have been opposed to Congress extending any pecuniary aid to the enterprise.

The financial prosperity of the Exposition now being secured, it remains for exhibitors to lend their best endeavors to assist the Centennial commission in having the entire American part of the show in readiness by the opening day. Our correspondents at Philadelphia state that goods are arriving very slowly, and that present indications point to a grand rush during the month of April. This only entails extra labor upon the Exposition officials, and tends to produce troublesome confusion and dissatisfaction among the exhibitors. It is very much to be hoped that exhibitors will not follow their usual practice, at the annual fairs throughout the country, of thus waiting until the last minute before sending their entries. They will find early arrival on the field to be very much to their own and to the general advantage.

THE COLLAPSE OF THE SHEFFIELD AMERICAN STEEL RAIL TRADE.

In referring to the progress of the steel rail manufacture in this country, nearly a year ago, we took occasion to point out the rapid falling off in the importation of steel rails from England, and expressed the opinion that a still further decrease would follow. We have, moreover, long adhered to the belief that, with our vast stores of mineral wealth supplying the material, all that our people have needed is experience and knowledge in utilizing it; and as that experience and knowledge augmented, so would our reliance upon the labor of other countries decline. As matters stand now, to quote from the English *Ironmonger*, "in the management of the Bessemer plant, the Americans must be yielded the palm; and this palm was yielded even by the English steel masters themselves at their great Barrow meeting. The real truth is that the Americans have learned how to make steel rails as well, if not better, than Englishmen, and there is no good to be obtained by hiding the fact."

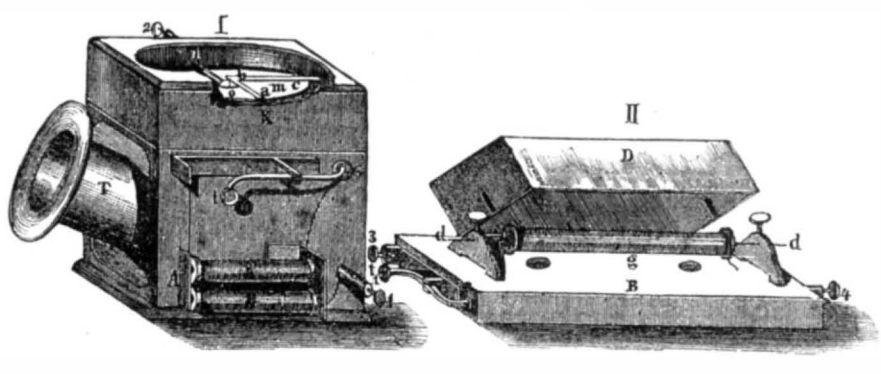
The reason of this candid admission by a leading English metal trade organ is found in the recent report of Dr. Webster, the American Consul at Sheffield. Steel makers in that great manufacturing town had felt severely the effects of a falling off in their American sales; but none, it appears, were prepared for the alarming announcement that the American market for their rails had practically closed against them. In 1873, Sheffield exported steel goods of all kinds to the United States of an aggregated value of $8,298,865; in 1874, this had fallen to $6,315,240; and the declared value of goods exported in 1875 still further falls to $3,456,160: a reduction of $5.000,000 in two years. Out of this aggregate of $3,456,160 for 1875, the value of the rails imported is but $11,505, and those rails were brought over here during the quarter ending March 31, 1875. Since that date, not a single tun of Sheffield rails has entered the country. For the last nine months of 1873 and 1874 respectively, the value of the rails imported hither was $1,311,890 and $1,136,610.

There are just four reasons for this loss of trade, which has stopped the machinery in several large Sheffield establishments. Two, namely, our high tariff and financial stress, might be urged with equal force as regards any other dutiable class of exports, and these, therefore, affect not a single branch of the latter, but our entire commerce with any foreign nation. The other two must be admitted as the more immediate causes; and these are, first, our progress, as already noted; and second, the blind conservatism, to use a mild term, of the Sheffield working men. So long as these men, through their combinations, persist in doing almost exactly as their grandfathers and fathers did to accomplish specific manufacturing results, so will they be distanced by more progressive people, irrespective of the nation to which the latter belong. Manufacturers, who employ a class of men who, again to quote an English contemporary, "display inveterate opposition to the use of modern mechanical appliances," must expect to find their productions unsought and their capital wasted; nor can they hope to compete with their American brethren, in whose more prosperous establishments the introduction of new machinery one year, and its abandonment for still further improved appliances before the twelve month has passed, are common occurrences.

THE INVENTION OF THE TELEPHONE.

BY P. H. VANDER WEYDE, M. D.

In connection with Mr. Gray's application of the telephone to the simultaneous transmission of several different telegraphic messages over one wire at the same time, and his paper read before the American Electrical Society (published on page 92, SCIENTIFIC AMERICAN SUPPLEMENT for February 5), it may be interesting for the readers of this paper to obtain some information in regard to the invention of the telephone, by Reuss. As mentioned in the article above referred to, Page and Henry observed that, by rapid magnetization and demagnetization, iron could be put into vibrations isochronic with the interruptions of the current; and later, Marian experimented extensively in this direction, while Wertheim made a thorough investigation of the subject, which induced Reuss, of Friedrichsdorf, near Homburg, Germany, to apply this principle to the transmission of musical tones and melodies by telegraph; and he contrived an apparatus which we represent in the engravings.



PROFESSOR REUSS' TELEPHONE.

The telephone of Reuss consists of two parts, the transmitting and the receiving instrument. Fig. I represents the former, and is placed at the locality where the music is produced; Fig. II, the latter, is placed at the station where the music is to be heard, which may be at a distance of 100, 200, or more miles, in fact, as far as the battery used can carry the current: while the two instruments are connected with the battery and the telegraph wire in the usual manner. One pole of the battery is connected with the ground plate, the other with the screw, marked 2 in our Fig. I, and thence over a thin copper strip, *n*, with the platinum disk, *o*, attached to the center of the membrane stretched in the large top opening of the hollow and empty box, K, intended to receive and strengthen the vibrations of the air, produced by singing before the funnel-shaped short tube attached to the opening in T. Over the platinum disk, *c*, attached to the elastic membrane, is a platinum point attached to the arms, *b c* and *b* K, while a set screw brings this point in slight contact with the platinum disk mentioned. A part of the box is represented as broken and removed, in order to show the internal construction. The strip, *a b c*, is connected with the end, *s*, of the switch, *t s*, and the screw connection, 1, at the lower right hand corner, and also, through the telegraph wire, to the instrument, Fig. II, at the receiving station, which may be situated at the distance of many miles. Here the current enters by the screw connection, 3, and passes through the spiral, *g*, surrounding the soft iron wire, *d d*, of the thickness of a knitting needle, and leaves the apparatus at the screw connection, 4, whence it obtains access to the ground plate, and so passes, through the earth, back to the battery. The spiral and iron wire, *d d*, is supported on a hollow box, B, of thin board; while a cover, D, of the same material is placed on top, all intended to strengthen the sound produced by the vibrations which the interruption of the current caused in the iron wire, *d d*, so as to make these vibrations more audible by giving a large vibratory surface, in the same way that the sounding board of a pianoforte strengthens the vibrations of the air caused by the strings, and makes a very weak sound quite powerful.

If a flute be played before the opening, T, or if a voice be singing there, the vibration of the air inside the box, K, causes the membrane, *m*, to vibrate synchronically, and this causes the platinum disk, *o*, to move up and down with corresponding frequency. At every downward motion the contact of this disk with the platinum point, under *b*, is broken; and therefore the current is interrupted as rapidly as the vibrations occur. Let, for instance, the note C be sounded; this note makes 64 full vibrations in a second, and we have, therefore, 64 interruptions of the electric current, which interruption will at once be transmitted through the telegraph line to the receiving instrument, and put the bar, *d d*, into exactly similar vibrations, making the very same tone, C, audible; and so on for all other rates of vibration. It is clear that, in this way, not only the rhythm of music can be transmitted (and this can be done by the ordinary telegraph), but the very tones, as well as the relative durations and the rests between them, can thus be sent, making a full and complete melody. The switch, *t s*, Fig. I, is intended, in connection with a similar one in Fig. II, to communicate between the stations, with the help of the electro-magnet, E E, to ascertain if station, Fig. II, is ready to receive the melodies; then it gives the signal, by manipulating the switch, which is received by the attraction of the armature, A, the latter arrangement being a simple Morse apparatus, attached to the telephone.

Professor Heisler, in his "*Lehrbuch der technischen Physik*" (3d edition, Vienna, 1866), says, in regard to this instrument: "The telephone is still in its infancy; however, by the use of batteries of proper strength, it already transmits not only single musical tones, but even the most intricate melodies, sung at one end of the line, to the other, situated at a great distance, and makes them perceptible there with all the desirable distinctness." After reading this account in 1868, I had two such telephones constructed, and exhibited them at the meeting of the Polytechnic Club of the American Institute. The original sounds were produced at the further extremity of the large building (the Cooper Institute), totally out of hearing of the Association, and the receiving instrument, standing on the table in the lecture room, produced (with a peculiar and rather nasal twang) the different tunes sung into the box, K, at the other end of the line; not powerfully it is true, but very distinctly and correctly. In the succeeding summer I improved the form of the box, K, so as to produce a more powerful vibration of the membrane, by means of reflections effected by curving the sides; I also improved the receiving instrument by introducing several iron wires in the coil, so as to produce a stronger vibration. I submitted these, with some other improvements, to the meeting of the American Association for the Advancement of Science, and on that occasion (now seven years ago) expressed the opinion that the instrument contained the germ of a new method of working the electric telegraph, and would undoubtedly lead to further improvements in this branch of Science, needing only that a competent person give it his undivided attention, so as to develope out of it, all that it is evidently capable of producing.

Before leaving this subject, I wish to draw special attention to the fact that the merits of this invention consist chiefly in the absence of musical instruments, tuning forks, or their equivalents, for producing the tones: any instrument will do, flute, violin, human voice, etc. If the aerial vibrations are only conducted into the box, Fig. I, the apparatus will send the pitch as well as the duration of the different tones, with the rests between, therefore not only transmitting perfect rhythm, but a complete melody, with its long and short notes. The two parts of the apparatus may even be connected each to a separate pianoforte; and if this were done in a proper manner, a melody played on the pianoforte connected with the transmitting instrument, Fig. I, would be heard in the pianoforte, at a great distance, connected with the receiving instrument, Fig. II.

Fighting Rams.

Says a correspondent of the Ohio Farmer: "At certain seasons of the year, rams are apt to develop their combative propensities, and those who keep several of them together often have trouble on account of their injuring each other. It is well known that they always 'back-up' to get a start to butt. Stop their backing-up and you disconcert them entirely. To do this, take a light stick (a piece of broom handle will do), about 2 or 2½ feet long. Sharpen one end and lash the other end securely to his tail: the sharpened end will then draw harmlessly on the ground behind as long as his majesty goes straight ahead about his business; but on the attempt to 'back-up' he is astonished to find an effectual brake in the rear. Don't laugh and call this 'all gammon;' but if you have a butting ram, try it, and the time to laugh will be when you see him jump out sideways, and whirl round and round, trying to inspect the machine, which will keep behind him."

DR. HAUGHTON has proved that the strength of the lion is only two thirds that of the tiger.

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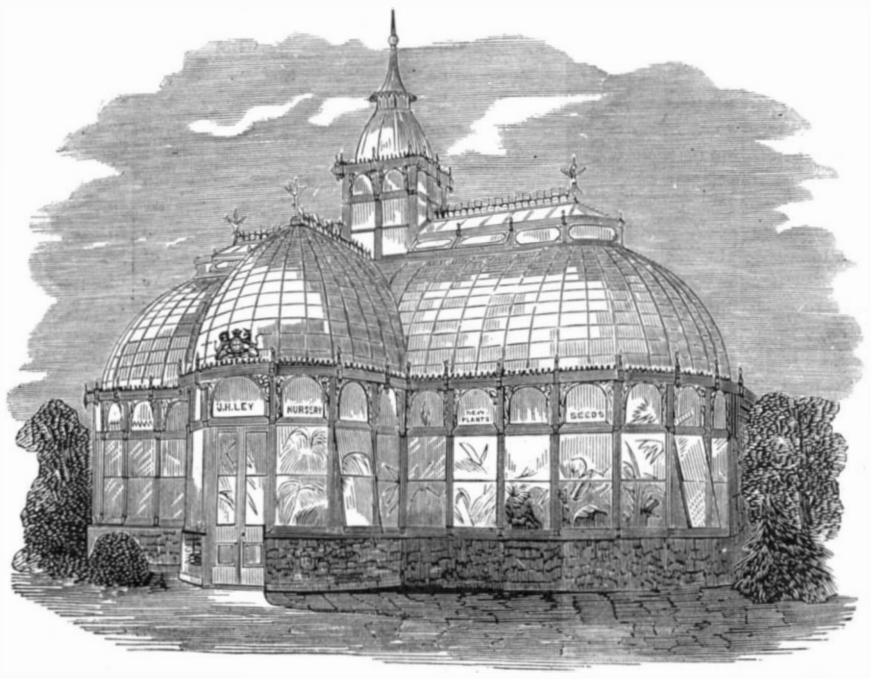
IMPROVED CONSTRUCTION OF CONSERVATORIES.

Our illustration shows a conservatory or greenhouse built entirely of wood and glass, according to a plan originated by Mr. W. H. Lascelles, of London, England, a builder who has obtained some renown among horticulturists. The roof of the house is curvilinear, the flat panes of glass being set in frames of bent wood, their angle to the perpendicular being gradually increased as the summit of the roof is approached. The result is a structure of very ornamental appearance, which can be erected by any capable carpenter. Iron, of course, will continue to be used where the framework can be readily and cheaply obtained; but that a very graceful building can be erected without the employment of expensive materials will, we think, be shown by our engraving.



A MODEL CURVILINEAR GREENHOUSE.

A Chance for Ice Machines.

It is a fact that the ice crop this winter, along the Hudson, is almost a total failure. Ice men have waited patiently for moderately thick ice to thicken; but in lieu of this taking place, the spells of warm weather, which have succeeded the few cold snaps, have only rendered the ice still less suitable for harvesting. Thus far, we learn, about one tenth of the usual crop has been gathered. Even when a full harvest is stored, hardly a summer goes by but that complaints regarding the extortions of the large ice companies are frequent. The householder in this city paid about 70 cents a week for 30 lbs. of ice delivered daily during last summer, when an abundant store of ice was on hand. Recently the ice companies have fixed the price at 60 cents per 100 lbs.; and probably, not merely on account of the failure of the crop, but also because of the unusual influx of transient visitors to this section of the country, the cost of ice next summer will reach figures not only higher than the above but higher than ever before. A good opportunity seems to be offered for inventors of ice machines. Without doubt powerful apparatus of this description, established in New York and Philadelphia, and capable of producing large quantities of ice, could be worked during the hot months both to the advantage of the public and with large profit to the manufacturers.

New Fire-Extinguishing Apparatus.

The new and splendid building belonging to the New York *Tribune* newspaper is one of the largest and most substantial structures in this city. It is eleven stories high, built of fireproof materials, with iron beams and hollow brick arches for the floors; and it would almost be deemed necessary to provide special apparatus for the prevention of fires. But the proprietors, with a commendable desire to protect the property of their many tenants, as well as their own, have lately put in a novel fire-extinguishing apparatus which is ingeniously arranged and effective in operation. It was made by the Champion Fire-Extinguishing Company of Louisville, Ky. A number of gentlemen recently assembled in the *Tribune* composing rooms to witness the first trial of it. The engine is placed in the sub-cellar of the building, and consists of a cylindrical tank, holding about 180 gallons of water, and hung on pivots in such a way as to be inverted on the lifting of a latch rod. About 60 lbs. sub-carbonate soda are mixed with the water, and in the tank is a jar containing 28 lbs. sulphuric acid. When the tank is inverted, the chemicals are mingled together and produce carbonic acid gas, by the expansive force of which the waste water is driven out with a pressure of 150 lbs. to the square inch. From the tank to the top of the building runs a standpipe, to which is attached a stop cock and hose in each story. A wire rope, connecting with the trip, also runs through the building. In case of a fire, it is only necessary to pull the wire rope on any floor, open the stop-cock, and direct the steam on the fire, the whole occupying about 20 seconds.

In the first trial, the trip was pulled from the composing room, eleven stories above the engine, and 20 seconds afterward a stream of water charged with carbonic acid gas was pouring from the nozzle of the 50 foot hose. With an elevation of 176 feet, and a length of pipe and hose amounting to 251 feet, a stream of water was thrown horizontally 75 feet from the nozzle against a stiff wind. It was estimated by those present that the stream of water could be kept up about half an hour. Several interruptions were made, as the stream was directed from different windows. After the force of the engine was exhausted, the spectators went to the basement, and witnessed the tripping of the tank. The tank was then refilled and made ready for use, the work occupying about ten minutes.

The main point in which this apparatus is believed to be superior to all others is the quickness with which the stream can be directed on the fire after it is discovered. A single person in any story, on discovering the flames, can immediately do the work which with other engines requires the aid of additional persons, and usually a journey to another room and back again In an ordinary building, several stories in hight, before a person could descend from the top to the basement, or warn the engineer of the danger, the fire might gain such a headway that no power could extinguish it. The apparatus is moreover simple in construction, and so made that it will not fail to act at a moment's notice, though allowed to stand for ten years without a change of chemicals. Another important advantage is that the action of chemicals, which come up mingled with the water, is such as to aid materially in stopping the fire. They do not seem to extinguish so much as instantly to smother it, and so render the charred wood incombustible. The fire does not return—even if it continues to rage a foot or two away—to the spot on which the spray has once touched it.

WASPS.

In the *Annual Register of Rural Affairs*, for 1876, we find the following article, from the pen of Professor Cook, of the Michigan State Agricultural College, on the value of the wasps in the economy of Nature, and their marvelous instinct: "If we consider as venial the injuries wrought by the strong-jawed insects belonging to the several families of the wasps, upon our grapes and other tender-skinned fruits—which sin is often laid to the bees—we may regard the wasps as wholly our friends. Not only the paper-making wasps, but also the numerous mud wasps, are without exception, so far as the writer has observed, predaceous insects. And what a strange instinct it must be that leads many of these wasps to spread for their prospective young a rich feast of tender grasshopper steak or cut-worm chops, when forsooth they never deign even to taste such vulgar viands, but only lap the more delicate sweets distilled by leaf and flower! Yet the common bee is just as wise, aye, and thoughtful too of its young, as it gathers the pollen nourishment for their sustenance, while it only tastes the delicious sweets of the hive.

Fig. 1.—VESPA MACULATA.

"The paper wasps, *vespa maculata* (Fig. 1) place the insect food in the cells with their young, while the fine mud wasps, so common around wells and muddy places throughout our country, build large, roomy mud cells in which they place the caterpillar, locust, or other insect, and then close up the cell, but not till they have left an egg with the canned meat. What a striking example of parental care thus to seal up so carefully the aliment provided for the young wasps, which very likely the parent wasp would never see! Yet in the *sphex ichneumonea* (Fig. 2) that beautiful shining wasp, with long peduncle to the abdomen, and often so handsomely colored with blue, orange, yellow, or red, we see even a more striking example of parental care. These wasps

Fig. 2.—SPHEX ICHNEUMONEA.

are possessed, like all other species of wasps, of a powerful sting; yet, when they attack and subdue their prey, preparatory to supplying the yet unborn, they never give a fatal thrust, but only paralyze their victims. These are then carried to a previously prepared hole in the ground, placed in its bottom, in company with an egg, after which the earth is filled in; and what is very curious, the wasp uses her abdomen as a beetle, pounding the earth, so that by no possibility may her prospective offspring meet with disturbance. Here, then, the grub, caterpillar, or moth is not only buried alive, but is to be eaten alive. So extraordinary is the mother's instinct of parental foresight that her yet unhatched progeny is insured not only a perfect sanctuary for a home, but also meat that is fresh and untainted."

The Effect of Waves.

It is generally believed that at a moderate depth the influence of heavy waves ceases, and that during a hurricane all is quiet a few fathoms beneath the surface. If this be correct, why should a swell show such a marked increase in hight when it rolls over the edge of soundings?

On the parallel of Cape Clear, in longitude 15° W., seamen are familiar with this phenomenon, although the depth is nearly 500 fathoms; at times it is so marked that the dead reckoning may be checked by carefully noting the increase in the depth of the hollow of the waves Shortly after the edge of sounds is passed, the sea becomes more regular, and consequently less dangerous to deeply laden vessels

Any one who has watched, during a moderate breeze, the commotion of the water close to a quay wall can form a good idea of the ocean when it receives its first check against the Irish Plateau; the great waves twist around each other, run up and down in heaps, and then fall suddenly, as if bereft, in a great measure, of their forward motion.

Again, it is a well-known fact that during a "norther" in the Gulf of Mexico the frailest vessels weather out the storm if they can cross the edge of the Campeachy Banks, a striking proof that, at a depth of over fifty fathoms, there is sufficient abrasion to destroy the force of the heaviest wave in a very effectual style. On one occasion the writer witnessed this remarkable fact by running from a turbulent sea into comparative smooth water in this locality.

On George's Shoals, off Nantucket, during a heavy gale, the New York pilots and masters of coasting vessels assert that sand is frequently left on deck after a sea has broken on board, although the depth of water may be twelve or fourteen fathoms. It must require an enormous amount of ebullition at the bottom to raise such a dense matter to the surface through such a distance; for a cubic foot of ordinary sea sand weighs about 100 lbs.

In this wild spot the tide, which frequently runs with a velocity of three miles per hour, would assist the lifting power of the wave if running counter to it. During a winter gale, when the strong springs are thus running, the confusion of the sea is indescribable, although the depth may be thirty fathoms. The shortness of the sea (that is to say, of the distance beween the crests of the waves) on the banks of Newfoundland, where the soundings are from 30 to 50 fathoms, is noticed by all the navigators of the Western Atlantic, as it reduces the speed of an ocean steamer more than the heavier waves of deeper water, with a similar force of wind, will do. It is evident that this can only arise from the friction of the bottom, as the waves increase in hight when deeper water is reached a short distance to the eastward.

In the Gulf Stream north of the Straits of Bemine, after a "norther" has blown a few hours, the surface of the sea is covered with lanes of weed, although only a few patches might have been seen before the commencement of the gale. As these lanes are often at a considerable distance from shoal water, which lies at right angles to the direction of the current and wind, it is evident that they must have grown near the spot where they float, and been torn from their moorings by the mechanical force of the waves.—*W. W. Kiddle, in Nature.*

Disinfection for Yellow Fever.

Whenever a case of yellow fever occurs in New Orleans, the streets surrounding the square are sprinkled with Calvert's No. 5 carbolic acid diluted in 50 parts of water. A large sprinkler on wheels is used for the roadways, and the sidewalks are sprinkled by hand. The grounds of neighboring yards are similarly treated, and the privy vaults disinfected with a solution of zinc-iron chloride. At the termination of the case by death or removal, the infected apartments are fumigated with sulphurous acid or chlorine. The extent of the ground disinfected is according to the lapse of time since the appearance of the fever. The extent of the infection along the ground is about forty or fifty feet daily, so that after some days' delay the whole square must be enclosed with a disinfecting band and the enclosed surface sprinkled.

The Microscope Again a Detector of Crime.

The microscope has recently completed a circumstantial evidence against a murderer, forging the links so strongly that numerous witnesses, swearing to an alibi, were of no avail in the criminal's behalf. The latter, a Polish Jew, enticed a female of his own sect to a cornfield, and there killed her with a butcher's knife. Suspicion being directed to the man, close examination of his garments elicited, first, blood spots, second, soil and vegetable matter on his shoes, and lastly, shreds of woolen fabric sticking to his coat. To all of these substances the microscope was applied. The blood was declared to be human, and its nature and probable age determined; the soil was pronounced identical with that of the field in which the murder took place, the particles of vegetable matter were recognized as bits of corn stocks and leaves, and the identity of the dyed wool with the material of which the girl's shawl was made was established. This, together with other evidence adduced, despite the ingenious theories put forth by the defense, convinced the jury, who found the prisoner guilty, thus consigning him to the gallows.

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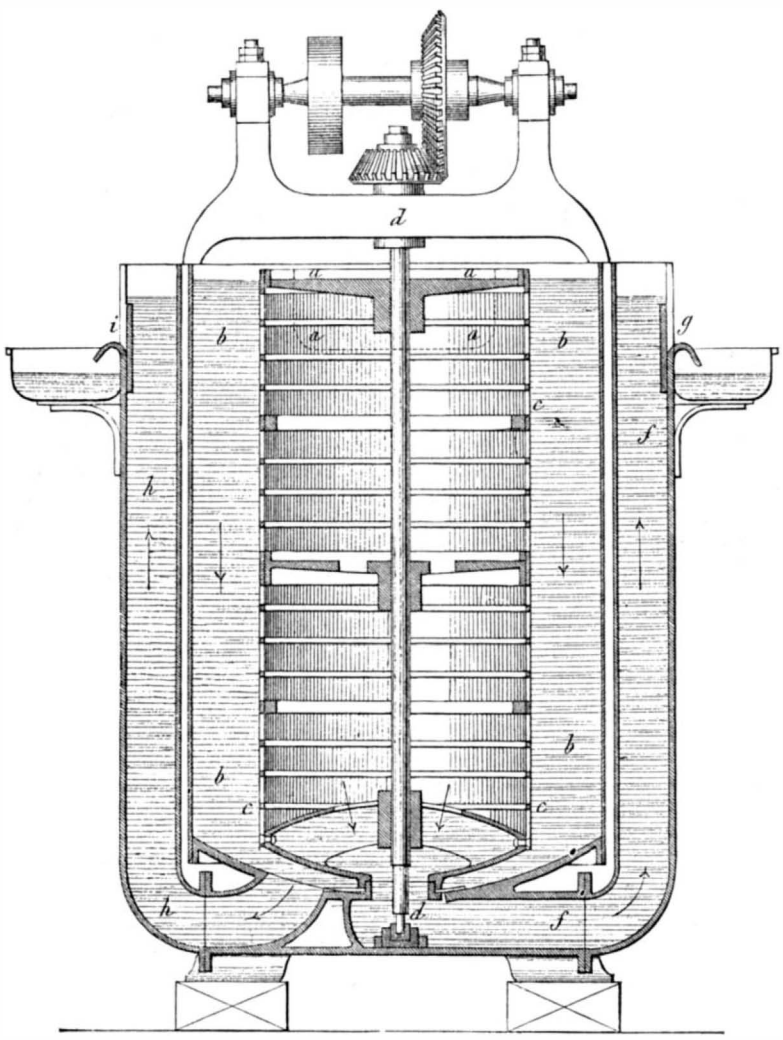
A NEW CENTRIFUGAL FILTER.

We extract from the Belgian *Bulletin du Musée* the annexed engraving of a new centrifugal filter, devised by MM. Autier and Allaire. The construction is based on the principle that, if a cylinder be rapidly revolved in a liquid in which solid particles are suspended, the liquid will be drawn into like rotation, and will revolve with a velocity, greatest next to the surface of the cylinder, and less as the distance from the latter is increased. The solid particles in the fluid will thus be thrown away from the immediate proximity of the cylinder, leaving the liquid there in a pure condition, when, by suitable pipes from that portion, it may be drawn off. The present apparatus consists of a cylindrical receptacle, *b*, into which the liquid enters at *a*, and in which is a vertical revolving cylinder, *c*, the surface of which is of metal, and is pierced with a number of apertures. The purified liquid enters these orifices, passes through the cylinder in the direction of the arrows to the tubes, *f*, and finally is drawn off at *g*, at openings the size of which may be suitably regulated by sliding covers. The solid particles, separated from the liquid, descend in the annular space, *b*, and escape by the tube, *h*, the aperture of which, at *i*, may also be regulated as above described.

It will be observed that this is a filter without filtering material, a fact of considerable advantage in industries like paper and sugar making, which require the filtration of large amounts of liquid. The filtering surface, moreover, never being in contact with the impurities, no opportunity is offered for the discharge orifice of the pure liquid to become choked or foul. The degree of filtration, of course, depends upon the length of time the liquid is kept in rotation, and this is easily governed by lessening, as desired, the escape of the contents of the apparatus at the orifices, *g* and *i*. A device of this sort might easily be driven by the engine of a factory or other works, and would require very little power.



A NEW CENTRIFUGAL FILTER.

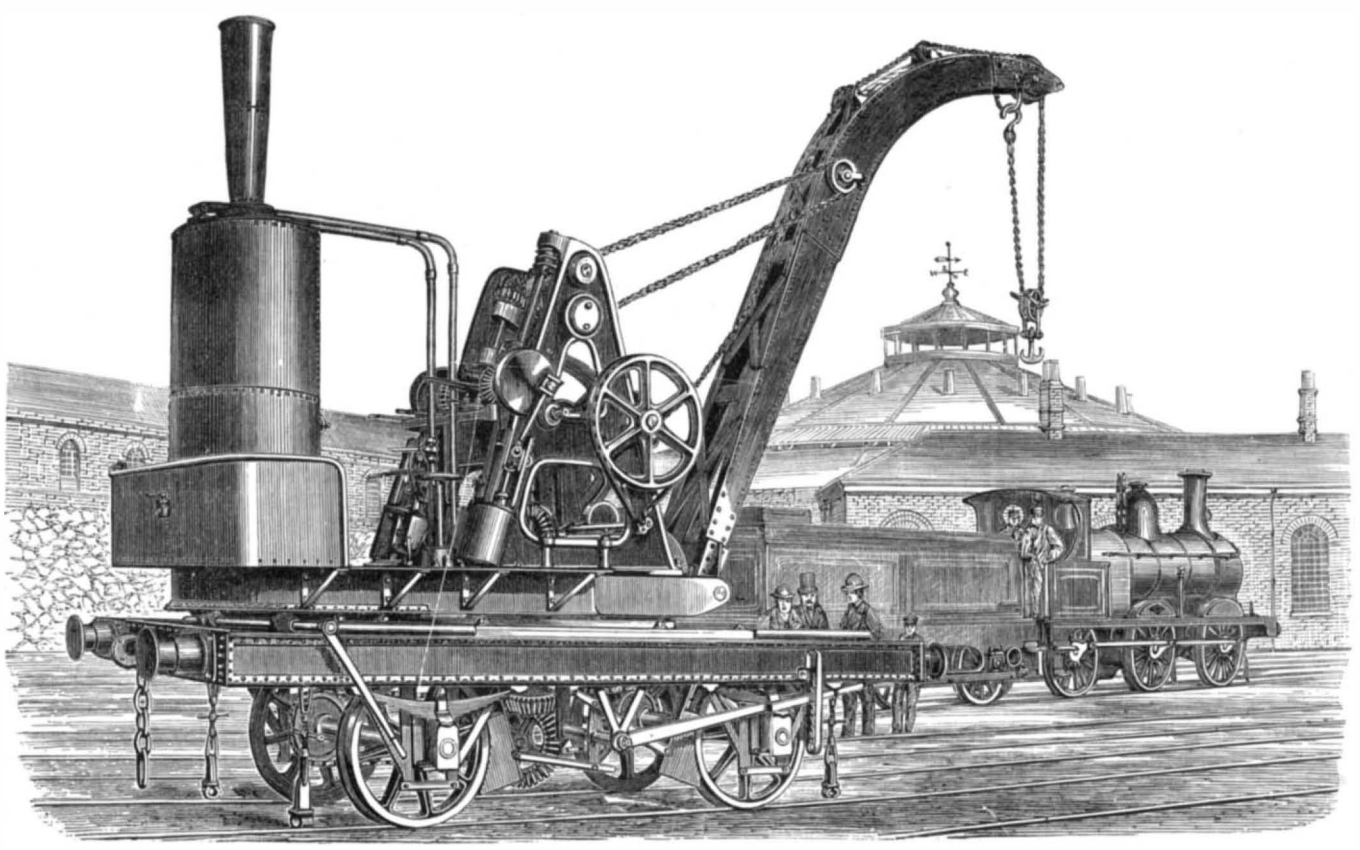
Chinese Fermented Drinks.

The ravages of the phylloxera among the vines of France have incited many attempts to discover a new kind of beverage to take the place of the juice of the grape. The Marquis de Villeneuve reports that in China a *pseudo* wine called *tsien-ia* is much used, which is concocted from a preparation of four plants, common in that country, and mixed together in certain proportions. The plants are dried and powdered, and made into a paste, which is sold in the form of balls or squares at the rate of about three pence a pound. One square or ball will make several pints of a fermented liquor, pleasant to the taste and much resembling wine, which is now sought after by Europeans and others living in China. A fictitious brandy is also prepared in the same way, and the manufacture is so simple that with a capital of $25 or $50 to purchase the apparatus, a man may make 25 gallons of "brandy" a day. The Marquis adds that the liquors possess no injurious matter.

PORTABLE CRANE FOR LOCOMOTIVE WORKS.

Our engraving shows an excellent adaptation of Messrs. Appleby's system of building cranes (heretofore described and illustrated in our pages) to the uses of locomotive shops and engine houses. The form is but little varied from that shown on page 95 of volume XXIX; but it has underneath the platform suitable gearing for propelling it automatically, and it can also be used for traction purposes. These cranes are now built of immense power and capacity with engines that are readily reversible, enabling the machines to be handled with facility; and they are coming into very general use, several of them having been employed in lifting and transporting heavy articles at the Vienna Exposition of 1873

Messrs. Appleby (of London, England) have certainly carried this branch of mechanical construction to a high pitch of excellence, and their cranes are already at work in the Machinery Department of the Centennial Exposition at Philadelphia, being employed in getting some of the heavy material into position.



APPLEBY'S LOCOMOTIVE CRANE.

Dangerous Soap.

We have remarked of late the introduction into the market, under high sounding names, of various strong potash combinations intended for laundry and cleansing purposes. One of these preparations, which appears to contain more caustic potash than any other ingredient, lately caused the death of a child who accidentally ate a little of it; and we have found the same stuff strong enough to remove old hard paint from wood work when merely wetted by the same and allowed to rest thereon for perhaps an hour or two. We advise our readers to let such preparations severely alone; they are ruinous to clothes, and, except to cleanse kitchen floors or other grease-soaked places, should not be used. Even the ordinary low grade soaps are heavily charged with soda and impurities, which, the manufacturers say, they are obliged to add in order to hold their own with fraudulent dealers who adulterate still more heavily; and these soaps are also highly destructive to fabrics. It is much better economy to purchase a good quality, even a superior quality, of white soap for household purposes; for the extra cost of the soap will, in the end, be more than saved in the lessened wear of clothes, of oil cloths, and of paint. It is hardly necessary to add that strong alkali soaps should never be used on the skin, as their effect is corrosive and harmful. The object of using soap for the toilet is simply to overcome the natural oil which exudes from the body, and render it possible for the water to combine therewith; and a very little of the mildest soap is ample for this purpose.

Turmeric.

We are aware that the coloring matter of turmeric (the *curcuma longa* of the pharmacopœia) has been more than once recommended as a substance likely to be useful in photographic work; but we hardly think it has received proper consideration, or that it has been utilized to the extent which its varied qualities would seem to warrant.

Our attention was recently attracted to the subject in consequence of a desire to protect, by a yellowish varnish, the very thin foreground of a negative we wished to print. For this purpose we added a few drops of a tincture of turmeric to a little plain collodion, and poured it over the whole plate. When dry, portions covering the better-exposed parts of the plate were scraped off, and the negative exposed under paper in the ordinary way. On examining the process of printing, we were somewhat surprised to find that, although the yellow film was exceedingly feeble, it snon actinic qualities were so great that, when the unprotected parts of the negative were fully printed, the parts covered by it were altogether untouched, and that, even after an exposure of two hours to full sunshine, there was no trace of decomposition of the silver chloride. This circumstance naturally prompted us to make a series of experiments, the result of which leaves no doubt in our minds that a solution of the coloring matter of turmeric should find a place in every photographic laboratory.

A convenient solution may be readily prepared as follows: Four ounces of well dried turmeric (*radix curcumæ*), which may be obtained from any chemist, is to be well bruised, or reduced to coarse powder, and moistened with alcohol. After standing for an hour or two, the damp mass is packed into a percolator (a lamp chimney with a piece of muslin tied over the smaller end answering well) and some more alcohol poured over it. If the packing has been properly done, the spirit last added will displace that which had been absorbed by the turmeric, and cause it to flow through the muslin at the rate of two or three drops per second. When the operation is fairly started, sufficient spirit should be added to give a bulk of four ounces of percolate, which will be a very strong solution of curcumin, capable of giving a fine yellow color to collodion, varnish, or any alcoholic solution.

A drachm of this solution added to an ounce of plain collodion, and poured over a plate of glass, gives a yellow film of great beauty, which, although it hardly seems to stop out any material quantity of white light, is so non-actinic that, when used in the window of the dark room, plates of the most sensitive description may be manipulated with perfect freedom from fog. The cause of this is quite evident from a slight spectroscopic examination, which shows that the violet is altogether absorbed, the green and red alone being transmitted. We know that some emulsion makers prefer a red, or rather ruby, light in their dark rooms. This can very readily be got with the turmeric, it being only necessary to add to the collodion a few grains of boracic acid, which, when the film is dry, and especially if heated, destroys its power of transmitting the green, giving a pure red light.

It is well known that the color of turmeric, in common with many other vegetable coloring matters, is gradually decomposed by light; but our experiments would seem to show that when enveloped in the collodion film, or when mixed with ordinary photographic varnish, it is much more durable than when in contact with the starch and other *matériel* of the turmeric root; and, even should it be found unsuitable for permanent use, it will assuredly be valuable as a temporary expedient.

But an alcoholic solution of curcumin is of more use than merely to exclude the actinic ray from the dark room; it is one of the best organifiers for a washed emulsion pellicle that we have yet tried. We added it to the extent of ten drops to the ounce of emulsion just previous to pouring into the dish; and as the curcumin is very

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sparingly soluble in water, it is not removed by the necessary washing, and gives to the redissolved pellicle a fine yellow color, which altogether prevents the necessity for backing of any kind.

We may add that we experienced some difficulty at first in removing the yellow appearance from the developed plates, but ultimately it yielded readily to a wash with methylated spirit. Our experiments have not been sufficiently extended to warrant any very strong statement as to the superiority of curcumin over other organifiers; but from what we have seen, we believe that it will be found in every way a most important addition to the *matériel* of the emulsion worker.—*British Journal of Photography.*

Correspondence.

Penguins.

To the Editor of the Scientific American:

I notice in your issue of January 29, an illustrated article on penguins, which calls to mind a little incident which occurred three years ago, in the South: A boat's crew and myself went fishing off Goff's Island, in the South Atlantic; on nearing the shore, we saw what appeared to be six or seven persons on a rock, and from their gestures they seemed to be hailing us. Supposing them to be the survivors of some ill-fated vessel, we rowed down to them and found they were penguins, who stood there, nodding their heads and flapping their fins, as if enjoying the trick they had played on us. We soon after went on shore at another part of the island, and there found the birds in large numbers, so thick in fact that they could be kicked over.

We also found great numbers of their eggs, which they lay in the sand, and we secured a large quantity of these and carried them aboard the ship. We also went on shore at Kerguelen's Island (the subject of your illustration) and there one of the sailors had his hands badly bitten, in trying to catch one alive. At the Crozetts, we again met the penguin family; and here several of the seamen brought them aboard, ate the flesh, and made pillows of the feathers. I made a cap of the skin of one, which lasted for a long time, the feathers making it waterproof. The birds are seen in great numbers at sea, and old sailors take warning of a gale by their quack.

But a more beatiful bird is found in the Southern Oceans. It is the albatross, the king of sea fowl. It seldom if ever goes on shore. I have seen hundreds of them, in schools, riding gracefully over the waves, and I succeeded in catching one by baiting a shark hook with a piece of pork. The bird measured 7 feet 8 inches between the tips of his wings. We made tobacco pouches of the skins of his feet, and pipe stems of the small bones of the legs and wings; and the skin was to be made into a muff, as, after pulling out the large feathers, a long heavy down is left, making it very desirable as a substitute for fur. The bill is long and crooked, similar to that of the eagle; and when hungry, the bird will devour food at an alarming rate.

The albatross can be found in immense numbers, and I have often wondered why it would not pay for capitalists to send out vessels to secure these birds for their feathers.

Pittsfield, Mass. W. E. DAY.

NEW PHOSPHIDES OF SILVER, AND A METHOD OF ESTIMATING SILVER QUANTITATIVELY BY MEANS OF PHOSPHORUS.

BY WILLIAM FALKE, PROFESSOR OF NATURAL AND PHYSICAL SCIENCES IN MANHATTAN COLLEGE.*

In the fall of 1873, the author's attention was attracted to the action of phosphorus upon the salts of silver, in particular the nitrate. If reference be made to most treatises on chemistry, it will be found therein stated that phosphorus is a powerful reducing or deoxidizing agent, and that by introducing a stick or clean piece of phosphorus into many metallic solutions, as, for example, copper sulphate, silver nitrate, or gold chloride, the metals are separated or reduced from their combinations, and are deposited upon the suspended phosphorus in the metallic state: at first such a fine film forming upon the phosphorus as to be transparent. Gold under these circumstances, appears beautifully green on viewing it by transmitted light, which color is characteristic of this metal, and by it it can be distinguished from spurious foils. Silver and copper are deposited upon the surface of the phosphorus in minute but brilliant crystals; and by very prolonged digestion, the whole, or nearly all, of the metal may be separated from the solution. In these reactions, the phosphorus, or part of it, removes the oxygen (or chlorine) from the metallic salts, precipitates the metal, and enters itself into solution.

In studying and experimenting upon the above detailed reactions, it occurred to me to dissolve the phosphorus in some liquid before adding to the metallic solution, whereby the phosphorus would be almost instantly diffused, and would, of course, offer an immensely increased surface for chemical action. The liquid in which phosphorus is most largely soluble is carbon disulphide, which is the solvent that has been almost exclusively employed in the following experiments:

On adding such a solution of phosphorus, which should not be too concentrated, to a solution of nitrate of silver in water, a dark and sometimes iridescent film is formed, which covers to some extent the sides of the glass vessels and also incases the globules of carbon disulphide at the bottom. A copious separation of the same black substance also precipitates, almost immediately on shaking.

The whole of the silver is thus removed in a short time from the solution, particularly on warming and stirring. Other metallic solutions, with different metals, were thus treated, most of which were completely thrown down in a short time, as copper, gold, platinum, etc.

Here it is important to observe that the precipitates and films thus obtained consisted not only of a part of the metals, but compounds had formed—combinations of phosphorus and metal.

After the above preliminary indications of an hitherto unobserved character, minute investigations were instituted in order to determine the nature of the compounds thus formed, and to see to what use, if any, they could be put. At present this report will confine itself entirely to the investigations on silver: the other results will appear in future communications. The following proportions were employed: Silver nitrate (fused), 5 grammes (77·16 grains); phosphorus, 1 gramme (15·41 grains); carbon disulphide, 10 cubic centimeters (0·61 cubic inch); water, 100 cubic centimeters (6·1 cubic inches). The fused nitrate of silver is dissolved in the water (more or less) and the phosphorus is then dissolved in the disulphide of carbon, which is then poured into the silver solution; the small vessel containing the phosphorus should be rinsed with a little carbon disulphide which should be added to the rest, as, if any phosphorus remains in the vessel, the volatile carbon disulphide would evaporate and leave some phosphorus in a finely divided state behind which may ignite or burn spontaneously when dry in the air. The mixture is then stirred in the cold, and allowed to stand for some hours until all the silver has been removed or separated, which can be determined by taking a drop out with a glass rod and touching it with a drop of hydrochloric acid or a chloride, until no longer a white curdy precipitate or opalescence of chloride of silver appears.

Immediately on mixing the above solutions, the silver begins to separate in films and in powder, which appears highly crystalline in part, and which is combined with phosphorus. When the reaction is complete, the liquid is poured off from the precipitate, and the latter washed two or three times with water by decantation, then with some strong alcohol to remove the water, and lastly with carbon disulphide to remove excess or free phosphorus, which is not in combination and must be removed.

The above is a brief description of the method employed whereby the black phosphide of silver was prepared and carefully purified from any free phosphorus. I was greatly surprised when the above compound suddenly took fire spontaneously while drying on the filter in the cold upon the funnel. A second portion was prepared with the utmost care, and washed at last with carbon disulphide until some drops of the filtrate could be evaporated from paper without becoming luminous in the dark, proving that all free phosphorus had been removed from the compound. The second time, I again had the opportunity to behold my fugitive black substance undergoing combustion, leaving metallic silver behind. The case was evident: the new phosphide was a pyrophorus, and burned spontaneously when dry in the air or in contact with oxygen.

In order to preserve some of the new phosphide in the dry state for examination, it was introduced into a tube or small flask while yet moist, and closely stopped with a rubber stopper through which two small glass tubes passed, one for the purpose of passing into the flask a dry current of carbonic acid gas and the other as the exit tube.

The flask with the moist phosphide is then placed over a water bath heated to boiling, and a steady current of the dry gas passed over it, which soon dries by the moisture being carried off by the warm gas through the exit tube. If a much higher heat than that of a water bath be employed, say a direct application of the flame from a Bunsen's burner (melting point of tin), the whole of the compound will be decomposed, and silver remain behind, presenting a beautiful spongy appearance, while the phosphorus is carried off with the current of hot gas, which is decidedly luminous as it escapes into the air and oxidizes. If the compound is dried without too great an application of heat, and is afterwards poured out into the air upon a plate, it takes fire, and leaves metallic silver with a little phosphoric acid behind, which latter can be removed by washing with some warm water. It was with the greatest difficulty that the molecular formula of this phosphide of silver was determined; it seems to be Ag P. Its molecular weight is 139. The affinity of silver for the nitrogen-phosphorus group is very feeble, as this compound, among others, plainly shows.

The action of nitric acid on the black phosphide led to a series of highly interesting observations, whereby several new and definite phosphides were obtained. On adding nitric acid (concentrated) in the cold to some of the moist black phosphide, which is generally mixed with some metallic silver, chemical action is set up and red fumes are evolved, during which some of the compound is dissolved, with whatever metallic silver may be mixed with it. A precipitate remains behind, having a brick red color, which at first was supposed to be amorphous phosphorus, but proved upon examination to be another phosphide, having the composition: $Ag_2 P_3$. Calculated: Silver, 69·90; phosphorus, 30·09; total, 99 99. Found: Silver, 69·44; phosphorus, 30·55; total, 99·99. This red compound is permanent in the air, and is much more stable than the first. It will be observed that, as the amount of silver increases, the stability of the silver phosphides becomes greater.

The red phosphide is soluble in concentrated boiling nitric acid, with perhaps the exception of a trace of a yellow compound which is undergoing investigation.

Other methods of operating were now employed. Instead of dissolving the nitrate of silver in water, it was acted upon in the dry way by a solution of phosphorus in carbon disulphide. Plenty of the solvent should be employed for the phosphorus; in this case, at least twenty times the weight of the phosphorus was employed.

In preparing the phosphides by adding a solution of phosphorus upon powdered dry silver nitrate, if not sufficient carbon disulphide is employed, a violent decomposition may take place. Operating thus upon a large quantity with an insufficient amount of the solvent, the writer was painfully injured by a powerful explosion, which produced a report like a blast.

A red compound is the result, that is, the particles of the dry powdered nitrate are covered by a red coating.

On treating the red precipitate with water, after pouring off the carbon disulphide, the nitrate of silver, which still remained undecomposed, is dissolved, and the reddish substance disappears, leaving a flocculent black precipitate, which was found to have the formula $Ag_3 P$. Calculated: Silver, 91·26; phosphorus, 8·73; total, 99·99. Found: Silver, 91·1: phosphorus, 8·8; total, 99·9. It is permanent in the air, unless highly heated.

It is curious to note the different results obtained by acting upon silver nitrate dissolved in water by means of the phosphorus solution, by changing the conditions: thus, by acting upon a concentrated silver solution in the cold without stirring, nearly pure silver separates in films which become quite thick, as, for example, in the following proportion: Silver nitrate, 4 grammes (61·7 grains); phosphorus, 0·9 gramme (13·8 grains); carbon disulphide, 10 cubic centimeters (0 61 cubic inch); water, 30 cubic centimeters (1·83 cubic inches).

By treating a very dilute solution of the nitrate, the silver completely separates into beautiful crystals, after the lapse of twenty-four hours. Silver nitrate, 1 gramme (15·43 grains); phosphorus, 0·2 gramme (3·08 grains); carbon disulphide, 5 cubic centimeters (0·305 cubic inch); water, 500 cubic centimeters (30·5 cubic inches). By this means very pretty crystals may be separated.

A New Cause of the Breakage of Railroad Rails.

Some interesting observations have recently been made on an Austrian railway line, which possibly may shed considerable light on the hitherto unexplained causes of the breakage of steel rails during cold weather. Cases have frequently occurred when such rails have been fractured, and yet the adjacent metal has presented no flaw to which the rupture could be traced.

The section of the Austrian road referred to is about eight miles in length, and is often blocked with snow. This obstacle is generally surmounted by strewing sand in front of the driving wheels of the locomotives and in putting on extra steam while running over the slippery section. The rails are of Bessemer and Martin steel, weighing about 62·8 lbs. to the yard. It was suggested that the sanding of the tracks caused them to heat, to be suddenly cooled again, however, by the low temperature of the air and by the falling snow. Besides the molecular construction of the metal being thus injured, there would be an extra amount of abrasion on the surface at the spots where stoppages occurred.

Examinations proved, says the *Ironmonger*, that these abraded portions varied in length from 2 to 9 English inches, $\frac{1}{16}$ to $\frac{1}{4}$ inch in depth, and extended over the whole breadth of the rail A train, in passing over the depressions so caused, necessarily experiences a certain shock; and it is reasonable to suppose that the concussion thereby communicated to the rail will be most felt when the ground beneath is frozen hard, so that the natural elasticity of the rail has no room to play. In three instances, rails so worn snapped asunder suddenly at the abraded portion, although no flaw or defect in the metal could be detected. This led to the removal of all abraded rails from this section of the line, amounting to twenty-eight lengths of Martin steel rails, and ten lengths of Bessemer rails. No similar case of fracture is known to have occurred in the iron or puddled steel rails previously in use, although the amount of abrasion they underwent must have been at least as great. The inference is that the improved rails of Bessemer and other steels, their superior strength notwithstanding, are less capable of withstanding concussion than the older rails, and consequently whenever they are used increased vigilance is requisite to prevent accidents in the winter time.

Proposed Optical Barometer.

When a refracting prism is successively immersed in media of different refractive indices, the ultimate angular deviation of the ray will, as is well known, depend in each case on the relative indices of the glass and the medium surrounding it at the time of the experiment. And as the refractive index of atmospheric air varies with its density, the amount of deviation of the refracted ray will be a measure of the density of the air, that is, will give the means of ascertaining the reading of the barometer at the time.

If the ray of light were made to pass through a number of refracting and totally reflecting prisms, the deviation would be increased. If with these prisms a microscope were combined, the prisms might be used as a barometer. Or if the ray be received obliquely on a number of pieces of glass, having parallel faces and slightly separated from each other, although there would be no angular deviation, there would be horizontal displacement which would admit of being measured by a micrometer. How far such an application would be of practical value is certainly doubtful, as the effect of changes of temperature on the prism itself might interfere with the very limited range of the instrument. Or again, it is possible that easterly, westerly, or other currents—or perhaps differences in the hygrometric state of the atmospher

*A part of this article formed the subject of a paper read before the New York Academy of Sciences (late Lyceum of Natural History), December 13, 1875.

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—may affect the index of refraction otherwise than by the mere changes of density which they produce. But if such be the case, the refracting prism will be useful in determining the existence and amount of such variations in the refrangibility of the atmosphere.—*Thomas Stevenson, in Nature.*

The Case was Postponed.

A tattered memorandum book was recently found on the steps of a very humble dwelling out West. Some of the entries are as follows:

"My father had a slight misunderstanding with a neighbor about a division fence which he had inherited from my grandfather. After several disputes he consulted a lawyer, who had a good many children, but little practice. This was fatal. A suit was commenced.

"Several years ago my lawyer said I must get ready for the trial. I did so, and went to court at every term. But it was postponed on every pretence which human ingenuity could invent.

"1871. March term--Counsel for defendant moved a continuance, because he was engaged in the Court of Common Pleas. Court granted the motion, but intimated, with great dignity, that such an excuse would never avail him again.

"September term—Counsel trying a case in an adjoining county. Judge hesitated, but yielded.

"December term—Defendant ill. Proved by the certificate of a respectable physician.

"1872. March term—Counsel had made an engagement to meet a client from New York, who could not conveniently leave his business again. Continued, the Judge suggesting that New York clients might find counsel nearer home.

"1873. September term—Carried the title deeds to my lawyer. Surveyor examined the premises, said the defendant had encroached on me. But another surveyor (partner and pupil of the first one) said that my deed spoke of a hackmatack stump in the line of the fence, a foot in diameter; whereas, the only tree anywhere near the fence was a pepperidge tree, not more than seven inches and a half across; case postponed to employ other surveyors.

"December term—Counsel agreed that Court might visit the premises in dispute. Judge refused to go, but said the jury might do so, provided that nobody went with them to explain and confuse. Next morning a heavy snow fell, and boundaries were covered. Case continued.

"1874. September term—Motion to postpone on the ground that the defendant's attorney wished to be absent, hunting for a few days. Motion prevailed. I remonstrated, but my counsel said the lawyers were very accommodating gentlemen, and the courtesies of the bar required it.

"1875. March term—One of the jurors taken sick. Motion to go on with the trial with eleven jurors. Defendant's counsel objected with great strength of voice, and demanded a full jury trial, pure and simple. I think he called it the 'palladium of our liberties.' Case postponed.

"September term—Received a bill for retainers, term fees, clerks' fees, and expenses. One item was for the amount of a retainer which my lawyer had declined from the defendant. Offered him the farm, provided I gained the case. He said this would not be deemed honorable practice, but he would take it, and give me credit as far as it went.

"Took the cars for the West, coming mostly on freight trains and after nightfall.

"Mem.—Don't forget inscription for tombstone: Here lies one who died of a lawsuit bequeathed by his father."

The above, from the Hartford *Courant*, we find copied into the *Shoe and Leather Reporter*, to which the facltious editor of the latter journal adds his experience as follows:

"Lest any reader should question the genuineness of the foregoing leaf from the experience of one unfortunate victim of litigation, we feel bound to say, as a fact within our knowledge, that in all but its *denouement* it is a faithful and accurate narrative of what most people must undergo who are unlucky enough to become involved in a lawsuit. We speak feelingly on the subject, for we have been for two years knocking at the door of the Supreme Court of the State of New York, praying for judgment on a claim so obviously valid that we are utterly at a loss to conceive any tenable ground upon which it can be defended. The debtor is anxious for delay, and the excuses by which he staves off a trial have been a great deal more numerous and far less cogent than many of those which are cited above. The other day we received notice from our counsel that the trial was positively to be 'reached.' We smiled incredulously, but nevertheless performed our customary journey to the court-room, with a cartload of books and a cloud of witnesses. To our great surprise the case *was* actually 'called,' a stage of progress far ahead of any that it had previously attained, and for a moment we were cajoled into the belief that the end was approaching, of one of the chief miseries of our existence. Vain delusion! The defendant's lawyer had a case to try in another court, and ours 'went over,' the judge and counsel on both sides acquiescing with as much readiness as if they considered it a matter of course. Not the slightest consideration was given to the circumstance that a dozen witnesses or more were waiting, as they had waited many a time before. Our own advocate smiled blandly while the adverse party mentioned that he was otherwise engaged, said never a word, but took up his hat and papers and left the room, very much with the air of a man who felt that he had been practising the recognized 'courtesy' which the gentlemen of the bar are so fond of displaying towards each other, when they have clients who are able to foot the bills.

"However, we were told to keep coming until these little hindrances were got out of the way, and we did. Sure enough, after several days of expectancy, it happened that there was no other case ready, and ours really *did* begin. The jury was impaneled, and our attorney rose to commence his opening. He had not got a sentence before his alert opponent interposed some objection. Then ensued a sort of conference between the two lawyers and the judge, and t turned out, as near as we could get at it, that our counsel hadn't put in the right sort of complaint—that it was not in such form as would admit of his getting his evidence in, and that everything must be done over again. And so here we are, with nothing to show for our two years of anxiety but keen realization of the eccentricity of law and the shadow of an impending bill of costs of sufficient magnitude to convince us that our system of judicature is the dearest of all human institutions.

"It may be said that our adviser was at fault. That may be. We are not well enough versed in the tortuosities of the profession to deny or affirm it. But he is eminent in his vocation, and quite as capable, we have no doubt, of protecting the interests of a client as the average of lawyers. We see by the frequency with which suits are determined, first one way and then another, until they practically come to naught in the final tribunal, through the discovery of some technical error that had been overlooked for years by astute and watchful practitioners, what an intricate, ambiguous, and inextricable paradox the law is, and how questions that seem perfectly simple in the light of common sense become bewildering mysteries when thrown into the judicial crucible.

"But after all, our grievance is slight compared with several others by which our friends and neighbors have suffered incalculable annoyance and loss. If we were to enter into a history of the wrongs we know to have been endured through the mischances of judicial procedure, we should awaken in the minds of our readers something of the aversion with which the very name of a lawsuit inspires us."

[Many, to our knowledge have suffered, by the law's delay, similarly to our friend Bailey, and the mysterious action of counsel in conducting the cases also has been incomprehensible to the clients. But it is seldom that we have read, from the pen of the litigant, so felicitous an account of his trials as the above.—EDS.]

Screws in Casings.

Mr. Griffiths, whose experiments with H.M.S. Bruiser we have heretofore mentioned, has been making some further trials with models at the swimming bath of the Greenwich Hospital Schools. The results which he has obtained from these latter trials are somewhat remarkable. Taking two models, representing the type of the long narrow and the short broad ship, both of the same displacement, and being respectively 5 feet long by 7½ inches beam and 3 feet 1½ inches long by 14 inches beam, Mr. Griffiths showed, by towing them at the ends of a cross beam, that the resistance of the water on the long one was to that on the short one as 3 to 5. On putting a pair of twin screws in the ordinary position at the stern of the long ship, and driving them for sixty seconds by means of a piece of clockwork machinery, the model was propelled through the space of 55 feet. The short vessel, however, with the screws in the same position was only propelled, with the same machinery, through the space of 28 feet in sixty seconds; but when the screws were placed inside tunnel casings with lip orifices, the model was propelled through a space of 62 feet, being, as will be seen, greater than that traversed by the long model when propelled in the ordinary manner. It was also found that, even when the screws were placed in the ordinary position in the short model, but the tunnels left open in front of them, a better speed was obtained than when the tunnels were closed, though not so good as when the screws were actually in the casings. The *Engineer* states that these results were considered of so much value by a gentleman representing the Imperial Russian Government, who was present at the trials, that, at his suggestion, Mr. Griffiths has undertaken to have a model of a circular ironclad made, and to conduct some trials therewith as to the difference of speed to be obtained by his system over that now used in the Popoffka, the circular ironclad.

Construction of Lightning Protectors.

"Whether the point of a lightning conductor is made of platinum or of copper, or whether it is sharp-pointed, as suggested by Franklin, or presents an angle of 30° in accordance with the latest notions, however great may be the care taken in welding the metals, it is certain that in this respect the mode of construction is defective as regards conductivity, and it is to be feared that the conductivity is diminished by the action of the weather. But it appears further to be demonstrated that it is at the joint that a lightning protector is most often destroyed; it is there the discharge takes place.

"At first, Franklin proposed that the conductor should be made of one metal only. It is owing to the rapid oxidization of iron that the successive commissions have proposed to modify the nature of the extremity of the conductor. We think that it is possible to return to the original idea, since it is known how to cover iron with a metal (nickel) which forms on its surface a film perfectly protecting it from oxidization, and possessing the necessary conductivity.

"We have experimented with the conductivity of nickel spread over a rod of iron. The nickelized surface indicated a rather higher conductivity than the mass of iron; it resisted better the electric discharges given off by a powerful battery. This same rod, after being immersed in water for 10 days, did not indicate any alteration, and the electric conductivity remained the same.

"We think, then, that, in the future construction of lightning protectors, it would be expedient to do away with the copper or platinum tips, the termination being made of a single piece of nickelized iron, in the same way as the conducting rod is made.

"The lightning protector would thus become a safeguard against electric discharges, and, owing to the preservation of its point, would always possess the same protective effect.

"Again, the conductivity would remain constant, and the necessity of supervision be done away with. This last condition is of great importance, as illustrated by General Morrin. According to him, it is desirable that you should be able to verify automatically the condition of the lightning protector as regards conductivity. In fact, every one knows that, if the conductivity is defective, the lightning protector becomes a source of danger."—*E. Saint-Edmé.*

The Practical Uses of Light.

A few days since, at the London Institution, Dr. Crookes read a paper on the radiation of light, in which he spoke of some practical applications that might be made of his discoveries. His scientific work is already well known, but these applications were for the first time laid before the public. He suggests that the torsion balance, which he has throughout used for testing the amount of action caused by the approach of light to it, should be employed as a test for the purity of our gas supply. First he would test the quality of the standard candles used, which it is known really vary very much when that variation is regarded from the standpoint of scientiffc accuracy. Then with the torsion balance, he would test the comparison between the gas and the standard candle, the slightest motion of the balance being capable of being recorded by the index scale on which the reflecting mirror shines. The other suggestion was the application of the rotating apparatus to meteorological purposes. He has arranged the windmill rotating wires with pith balls, so that they carry round a small magnet suspended beneath them. Their rate of rotation depends on the amount of light that falls on them.

Near the magnet attached to them is suspended another magnet, which oscillates as the attached magnet presents alternately its north and south poles. This oscillation is arranged to make and break an electric circuit, which, by a wire that may be of any length, is connected with a recording Morse machine worked by clockwork. Each revolution of the rotating pith balls is thus recorded by a punch of the Morse on a strip of continuous paper, and so a self-recording account of the amount of light falling at any place may be kept.

In our present meteorogical records, Dr. Crookes observes, we notice heat, rain, and pressure of atmosphere; but light, the most important influence, both as regards health and agriculture, is neglected, because not till now have means of measuring it been known.

Ventilation of Ships.

The Malabar, British troopship, which recently left Portsmouth for Bombay with the 21st brigade Royal Artillery, is fitted by Messrs. Mosses & Mitchell, of London, with a couple of automatic ventilators. This new system of ventilation is reported to have answered admirably on board the Osborne royal yacht. An air receiver, 6 feet high and 22 inches in diameter, is placed on each side of the ship and connected with pipes 8 inches in diameter. These connecting pipes are filled with water, and the principle of the contrivance is simply this: When the vessel rolls at sea, the water rushes to starboard and forms a vacuum in the port receiver, into which the foul air of the ship is instantly sucked. On the return roll the water rushes to port, drives out the air, and leaves a vacuum in the same manner in the starboard receiver; and such is the extreme force with which the foul air of the ship is expelled, that it is to be used on board the Malabar for the purpose of sounding a fog horn which shall be heard a mile off.

A Well Made Steamer.

The Great Britain steamer was one of the first made iron vessels, and among the earliest to ply regularly between New York and Liverpool. She has lately arrived at the latter port from Melbourne, Australia, thus completing her thirty-sixth trip round the world. She was designed by Brunel, and built at Bristol, and in July, 1845, made her maiden voyage from Liverpool to New York in fourteen days. Her dimensions are: Length (extreme) 330 feet, breadth 57 feet, depth 32 feet, with engines by Penn, of 500 nominal horse power.

The weight of iron used in her hull alone is 1,040 tuns, which is about equal to an average thickness of 2½ inch. Since 1852, independent of her employment in the Crimea during 1854 and 1855, she has sailed over 1,000,000 nautical miles, her last voyage out from Gravesend to Melbourne only occupying fifty-four days, and when recently surveyed she was pronounced to be one of the strongest vessels in the mercantile marine.

A New Fish.

Mr. J. M. Hutchings, of Yosemite, is reported to have discovered in the head waters of Kern River, 10,500 feet above the sea, a new and beautiful fish, which he names the golden trout. It color was like that of the gold fish, but richer, and dotted with black spots a quarter of an inch in diameter, and with a black band along its sides.

A FRUITFUL source of malaria is found in the earth adjoining ponds which are dammed for manufacturing or other purposes. The soil in the vicinity, through the water being raised above its previous level, becomes soaked, and hence damp and very dangerous to health.

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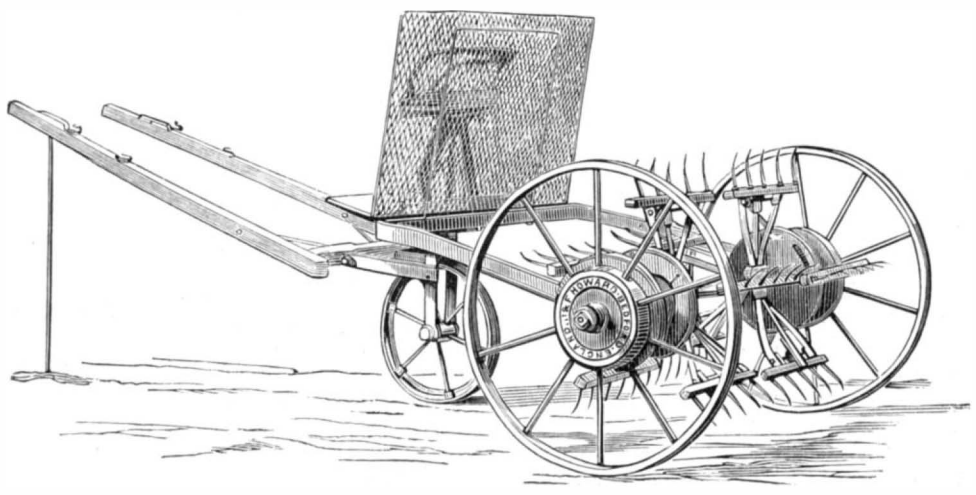
IMPROVED HAY TEDDER.

Our engraving shows a new hay tedder, invented and manufactured by Messrs. J. and F. Howard, of Bedford, England, a firm widely known for the excellence of their agricultural machinery, both as to design and manufacture.

The rotating forks are operated by the traction wheels, being made very light and easily operated; and the driver is protected from the shower of hay by a screen of wirework placed upright behind him The machine is easily drawn by one horse.

The simplicity of such devices ensures their moderate cost, and their consequent extended use in superseding manual labor. In changeable climates, the rapid drying of the hay is a matter of great importance, and the slow process of turning it by hand is vexatious as well as expensive to the farmer. These disadvantages are got rid of by the use of several machines, the one which we represent being among the latest and best for the purpose.



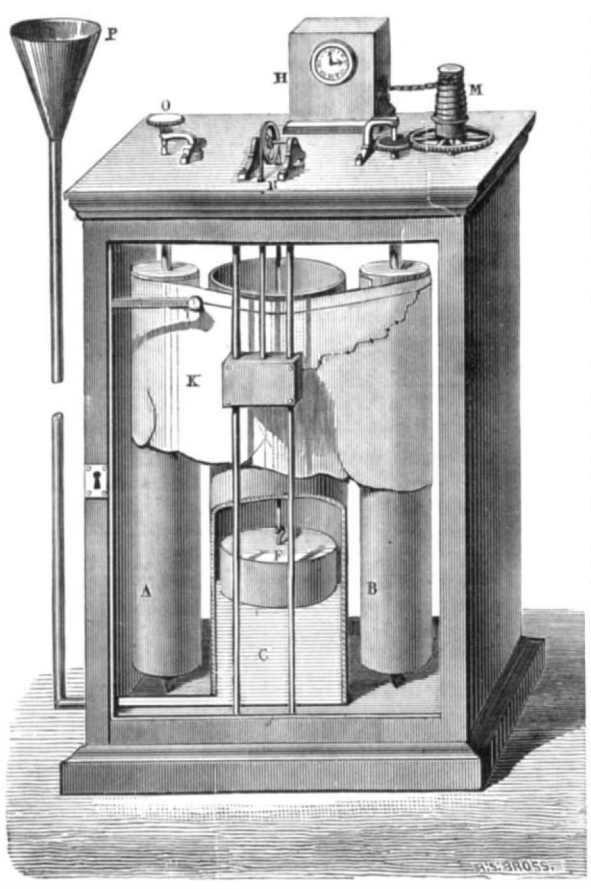
J. AND F. HOWARD'S HAY TEDDER.

Life-Preserving Pigeons.

Some very interesting and successful experiments have recently been conducted in France, with a view to determining whether lines could be sent ashore from a stranded ship by the aid of pigeons. It is in one of Mr. Charles Reade's novels that a means of escape is offered to a prisoner confined in a lofty dungeon. through some one shooting into his window an arrow to which a fine thread is found to be attached. The captive pulls the thread in and finds connected to it a string; the string gives place to a good sized cord, and the last to a rope capable of bearing his weight, and down which he descends. The pigeon from the wrecked vessel takes the place of the arrow, and, when liberated and naturally flying to the land, is able to convey thereto a thread 400 feet in length and 0·002 of an inch in diameter. People on the beach, by pulling on the thread, obtain a cord, and so eventually a strong rope completes the communication between ship and shore.

A NEW REGISTERING PLUVIOMETER.

The pluviometer is an instrument used to measure the quantity of rain which falls over a given surface, the knowledge of which fact is very useful in meteorological operations. The ordinary instrument, however, is defective in two points: First, it gives no record of the varying intensities or temporary stoppages of the rainfall; nor, second, does it afford any indication of the length of time during which such differences or stoppages in the intensity of the fall occurred.



M. Hervé Magnon has invented a new apparatus which satisfies the above want, and an engraving of the device is here presented, extracted from *La Nature*. A cylinder. C, receives the rain water led from the receiver, P. In the cylinder is a copper float, F, which, by means of a very fine cord passing over the pulley, N, is connected to the weight, K, which is a little the heavier. The weight, K, slides on two guides of tightly stretched pianoforte wire, and carries a pencil, the point of which comes in contact with the exterior of the cylinder, C. Inside the weight, K, which is hollow, is a small electric interrupter, which, whenever a current is transmitted to it from a regulator, strikes against the pencil and produces indicated points on a curve, which serves to control the clock movement by which are actuated the two copper cylinders, A and B. Over these last a belt of paper is passed, as shown; and the mechanism in H, which, as stated, moves them, is provided with a regulating fusee, M, so as to compensate for the difference caused in the diameter of the cylinder, B, by the rolling thereon of several thicknesses of paper. I is a fixed pencil which traces a horizontal base line on the paper. The latter, after first being rolled about the cylinder, A, is carried over cylinder, C, and attached to cylinder, B. In the middle cylinder sufficient water is then introduced to completely buoy up the float, F. If rain falls, the float, by the addition of water beneath it, is lifted; and the weight, K, following the movement, the pencil thereon traces a curve on the paper, which gives in millimeters the corresponding depth of rain. If, on the contrary, no rain falls, the line left by the weight pencil is straight and parallel to that made by the fixed pencil.

The Use of Plaster in Architectural Decorations.

In the earliest written records we hear of mortar being used as a plaster, while examinations of ancient Asiatic remains attest the fact. The Romans, we know, largely used plaster incrustations on their brickwork. The Coliseum shows plastered surfaces, and the early gothic structures were largely faced with stucco. It is a mistake to imagine that the middle age builders never used such a material. In many of the earlier churches and monasteries we find rubble walling; and a coarse rubble used in the vaulting, which was covered with a rough plaster, and probably decorated. Painted decorations have been discovered on the walls, and no doubt the vaulted surfaces were sometimes also relieved by color. The existence of plaster on the vaulted surfaces is proved in many instances by the ribs of the groining projecting before the face of the rough rubble filling-in, which formed a good key to the plastering. Netley Abbey and many other monastic buildings of the twelfth and thirteenth centuries may be cited.

"The subject of internal incrustation," says Mr. Pullan, "leads us to speak of the use of colored mortar for this purpose. . . . Painting cement and stucco has not been found advantageous, though the custom largely prevails. Painting the surface of calcareous cement does not improve it; the paint retards the induration by cutting off the air; and a sufficient time to allow of perfect evaporation of moisture is required. The same authority asserts that, if paint or oil be applied on stucco, it ought not to be used in less than a year after the incrustation is made. This observation is confirmed by plasterers and painters.

"But the employment of different ingredients with mortar shows far better results, that may be turned to account in decorative plastering. Metallic substances like antimony, white lead, arsenic, martial pyrites, are injurious; they give colors which are not permanent, and calcareous cements exposed to the weather are found to be best without metallic matter. Among the more durable ingredients for imparting color, without injuring the cement, may be mentioned colored sands, and coarse powder of durable colored bodies. Thus Thames sand produces a gray tint like Portland cement. Yellow and other beautiful colored sands are obtainable in the Isle of Wight, Croydon, etc.; or colored glasses or stones, in place of sand or partially, may be employed to give deeper tints. These should be beaten to a coarse powder, the fine portions being washed away as injurious to the cement. Colored mica and marble may also be used in external plaster work instead of paint. Bone ash produces by admixture a pleasing gray, which may be contrasted with brighter stuccoes of sand. Substances insoluble in water have been found best for the purpose of tinting cements, while sulphurated and metallic powders impair them for external use. Colored calces of iron produce a deep tint, and may be used in internal incrustation. Any colored, hard, gritty body may be incorporated with mortar for incrusting purposes. We have made great advances lately in this direction. The sgraffito treatment of plaster is one that admirably shows what artistic effects may be produced by simple means in fit colors and relief: though it seems to us, more may be done in tinting our plastered surfaces in light tones, and in rendering paint and paper less necessary for finished decorations."—*The Church Builder.*

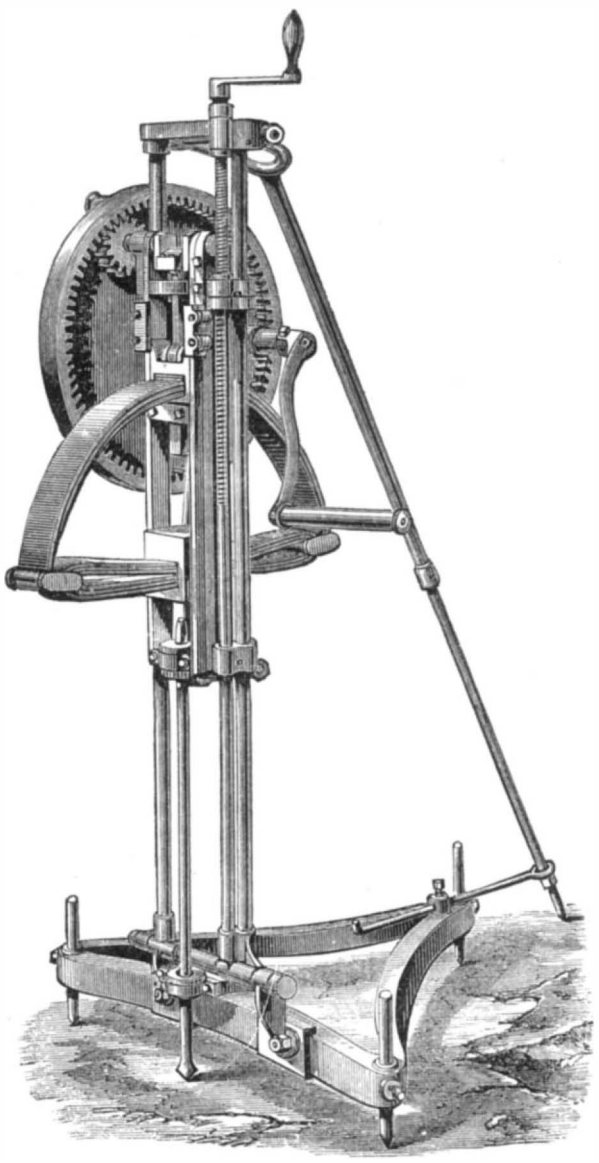
SPIDER web silk is 6·3 times finer than that of the ordinary silkworm.

Grease Butter in the English Courts.

The English butter men have revolted against the grease butter, and the English *Grocer* publishes a vehement editorial, demanding a law to the effect that people who make grease butter shall inform the public of the fact by marks on the packages. Somehow John Bull fails to comprehend the butter question as clearly as astute American dealers have done. Here is a report of a case where a London grocer is summoned for selling as butter a pound of something which the complainant avers does not contain a particle of the genuine article. The trial comes off, learned professors swear to flatly different statements, and the magistrate paradoxically and complacently observes that he is "perfectly satisfied with the analysts on both sides," whatever that may mean. The composition of the grease stuff is adjudged to be "consistent with genuine butter;" whereupon the *Grocer* rises in its wrath and insists that the butter, which a jury of its countrymen solemnly pronounces to be butter, is not butter, but a "curious mixture of fats." There is an exasperating obscurity about the whole business. As near as we can understand it, somebody has been feeding the British Lion on grease butter, which that noble beast has eaten innocently, and relished; but now, having discovered a fraud, he roars to have the noxious substance pointed out to him, in order that he may not commit the error of eating it again. "Where ignorance is bliss, 'tis folly to be wise" doubtless will hereafter be the British grease butter man's motto. Similar stuff is now being sold in France.

ROCK-DRILLING BY HAND POWER.

We select from *Engineering* an engraving of a rock drill operated by hand, intended for use where neither steam nor pneumatic power is available. It has recently been patented by Messrs. H. B. Barlow, Jr., & Co., of Manchester, England. The machine consists of a light stand, supporting guides which can be adjusted to various inclinations, the particular machine shown being adapted for drilling holes vertically or at angles down to 45°. The boring tool is not connected to the hammer, but rests on the rock, being merely guided by the collars through which it passes and which insure its being kept parallel with the hole which is being formed. One of the guide collars has an intermittent rotary motion given to it by a ratchet, thus causing the tool to be partially rotated after each blow.



The tool is struck rapidly by a steel-faced hammer worked by a crank through the medium of a spring. The throw of the crank is 1¼ inches; but when in full work the hammer, under the action of the spring, moves about double the stroke due to this throw, a speed of 40 revolutions per minute of the handle causing 212 blows per minute of about 5 inches fall to be struck by the hammer. The machine was awarded a prize at the recent exhibition at Manchester.

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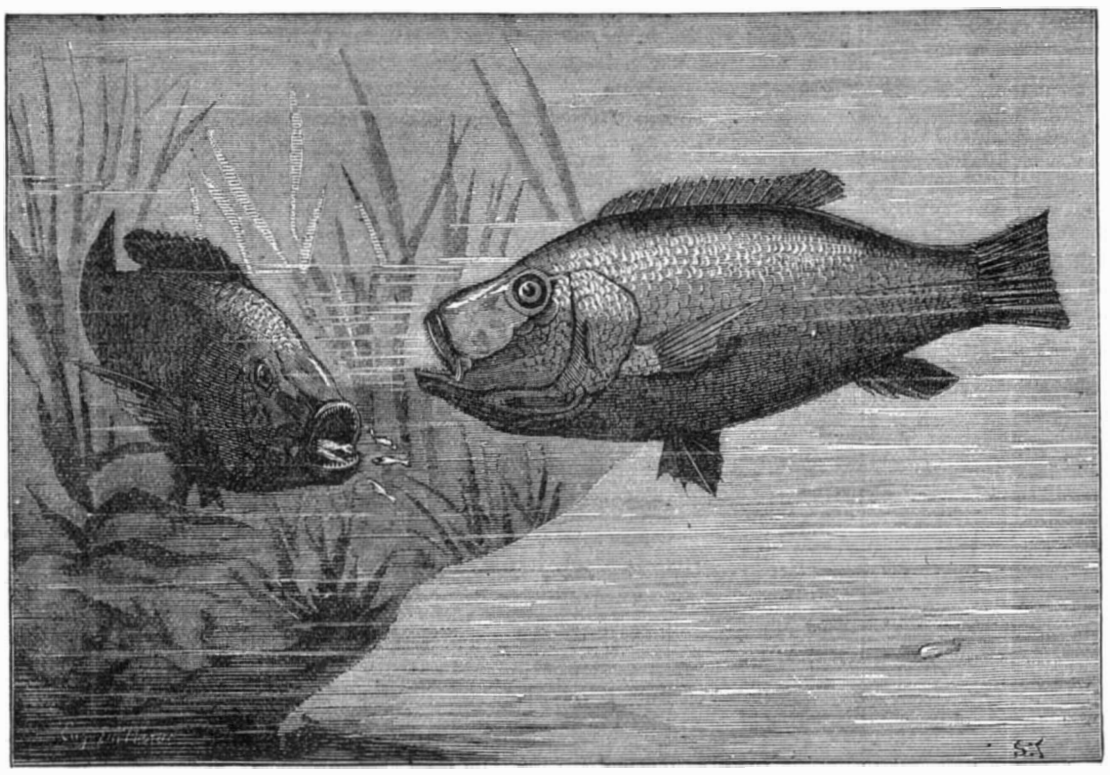
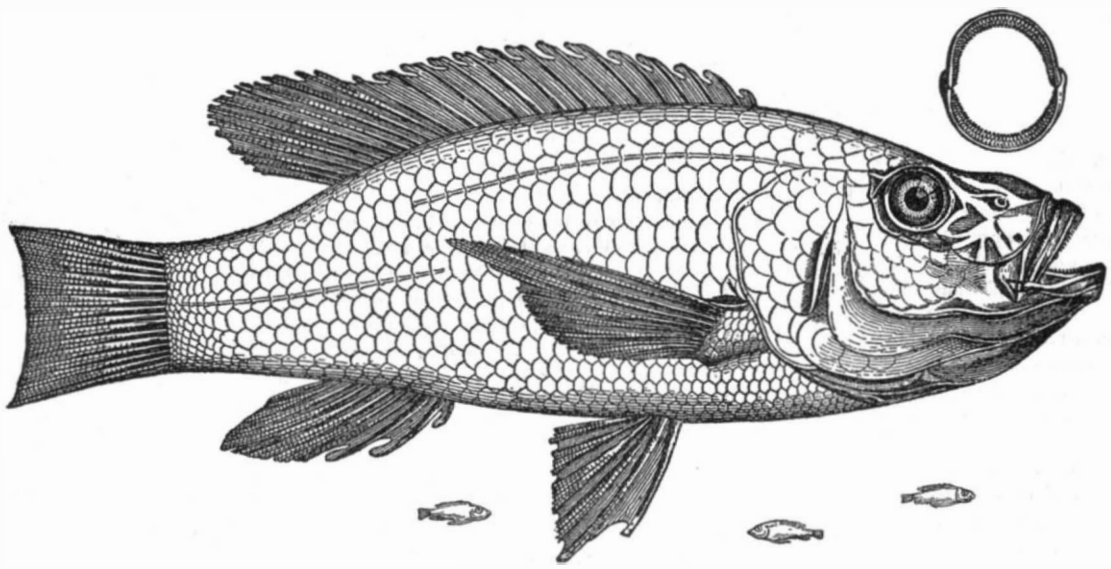
THE CHROMIS PATERFAMILIAS.

Up to the present time naturalists have recognized but very few fishes which incubate their eggs in the mouth or in the gills. Agassiz, during his voyage up the Amazon river, discovered one species. Latterly the macropode, a Chinese fish of very singular characteristics, has been remarked to have the same peculiarity. Both the macropode and the species noted by Agassiz belong to the great group of *labyrinthobranchia*; and it was the opinion of the abovenamed naturalist that to that order alone belonged all fishes which, through the possession of a bronchial sac, are enabled therein to incubate their eggs in so curious and abnormal a manner.

The recent discovery, however, of the *chromis*, having the same peculiarity, shows that Agassiz was in error; for this creature has gills disposed in simple layers, and is wholly destitute of any special apparatus for retaining either eggs or fry, and yet it carries upwards of 200 young fish in its gills and mouth. This remarkable incubation is done by the male. When the female has deposited her eggs in a sandy cavity or among the weeds, he approaches and by an inspiration draws them into his mouth. A peculiar movement then follows, the mechanism of which is as yet unknown, but the result is to force the eggs between the leaves of the gills. The gentle pressure on the eggs, afforded by the gill layers, serves to keep them in place, and there, in the midst of the respiratory organs, they undergo their changes. The young grow rapidly, and soon struggle to escape from their narrow prison. Eventually they find an exit through the opening into the mouth of the parent, and there they crowd together as thickly as the seeds of a pomegranate, distending the jaws of the old fish until the mouth is unable to close. Sometimes the young, although in a perfect state, remain in the gills, all, however, with their heads directed toward the mouth of their progenitor. How they pack themselves together, how the parent manages to feed without swallowing his offspring, and when the latter finally escape from the mouth, are matters still unknown.





THE CHROMIS PATERFAMILIAS.

The chromis, an excellent representation of which is given in the annexed engraving, taken from *La Nature*, is seven inches in length and one inch and seven tenths in hight. The teeth are very fine and acute, and disposed in several series, and are of a yellow tinge. The scales are cycloidal, more broad than high. The color on the back is an olive green, shot with blue. The belly is brilliant silver, marked with green and blue. The fish is found in Lake Tiberias, in Palestine, near Ain-tin, the site of ancient Capernaum. In that locality there are several hot springs which unite to form a moderate-sized stream which enters the lake. The chromis is principally met with in the hot waters.

Medicated Ice.

The possibility of using antiseptics in medicine was recently pointed out by Mr. Edward Martin, in a letter to the *Lancet*, from which the following is taken:

"Every practitioner has at times to face the difficulties of the scarlatinal throat in young children. It may sadly want topical medication; but how is he to apply it? Young children cannot gargle, and to attempt the brush or spray often fills them with terror. In many cases neither sternness nor coaxing avails. Yet these little ones in almost every case will greedily suck bits of ice. This has long been my chief resource where I could not persuade the child to submit to the sulphurous acid spray. Lately I have been trying an ice formed of a frozen solution of the acid (or some other antiseptic). Though, of course, not so tasteless as pure ice, the flavor is so much lessened by the low temperature, and probably also through the parched tongue very little appreciating any flavor whatever, that I find scarcely any complaint on that score from the little sufferers; they generally take to it very readily. The process of making it is very simple. A large test tube immersed in a mixture of pounded ice and salt is the only apparatus required, and in this the solution is easily frozen. When quite solid, a momentary dip of the tube in hot water enables one to turn out the cylinder of ice as the cook turns out her mold of jelly. I have tried the three following formulæ, all of which answer, though I think I prefer the first:

1. Sulphurous acid, ½ drachm; water, 7½ drachms: mix and freeze.
2. Chlorate of potass, 1 scruple; water, 1 oz.: dissolve and freeze.
3. Solution of chlorinated soda, ½ drachm; water, 1 oz.: mix and freeze.

"However, the form is of secondary importance, as each practitioner can construct his own. Boracic acid, salicylic acid, or any other harmless antiseptic with not too much taste, would, doubtless, be as useful as those indicated."

Making Maple Sugar.

"A great many farmers," says a sugar making correspondent of "*The Christian at Work*," residing in Ohio, "might make a few hundred pounds of superb maple sugar, and a barrel of superb maple sirup, just as well as not. They have the trees, an abundance of cheap help, and wood that would cost nothing except the labor of preparing it for the fire. The only difficulty in the way is a disinclination to engage in such a job. Let us make our own sugar this year," says the writer, and then follow his directions for doing it.

"My process of reducing the sap is this: I keep the larger pan supplied with fresh sap, by means of a spout with a coarse cloth strainer over the end, from the reservoir, so adjusted as to admit a supply equal to the evaporation from the pan. From time to time I transfer sap from the larger to the smaller boiler, passing it through a fine woolen strainer. After accumulating a desired quantity in the small pan, and reducing it to a thin sirup, it is clarified by putting into a quantity which will make three or four gallons of molasses the white of an egg beaten up with about a gill of sweet skimmed milk. The sirup should not be hot enough to cook the egg. The egg and milk will entangle any sediment or foreign matter in the sirup, so that when brought to the boiling point everything will rise, when it is skimmed off, leaving the sirup clean. I then continue to boil it as rapidly as possible, till it is reduced to the desired consistence. I reduce my molasses to what I suppose to be about 38° B. My process of making sugar is to reduce the molasses to a degree which I should think to be about 48° or 50°, and pour it into a cask with one head out, with a spile at the bottom, to which other lots are added from time to time, as they are made. In a short time the mass will begin to granulate; and after having stood some days the molasses will drain out, leaving a white and beautiful sugar."

Borrowed Plumes.

An indignant naturalist writes to the London *Times* denouncing the ladies' fashion of ornamenting their dress with spoils from the feathered kingdom. A chance catalogue, or portion of a catalogue, of a sale of birds' feathers was the provoking cause of his communication. He says:

"The second page of this document (the first being occupied by the title) relates to 2,077 bundles of herons' or egrets' feathers (they go by other names 'in the trade',) the weight of which I find to be given as 702 ounces. How many feathers may go to a bundle I cannot say; but weighing some twenty exceptionally stout feathers (not herons') which happened to be on hand, I find them to balance one fourth of an ounce exactly. I think, therefore, that these 2,077 bundles cannot well contain fewer than 56,160 feathers; and allowing twenty of them to each bird (which I believe to be a fair allowance), we have evidence of the death of 2,808 herons or egrets. The next page relates to 2,948 similar bundles, weighing 1,168 ounces, showing, on the same estimate, 4,672 birds. To this follow other lots, which, in like manner, I compute to represent 2,220 birds, or in all 9,700 herons or egrets. All these lots are said to have arrived from India, and nearly all to have been warehoused last autumn. The spoils of how many more birds were included in the catalogue itself, to which this is a first supplement, or of how many in the second supplement, I, of course, cannot say; but, even if there were none, I venture to affirm that no country could long supply nearly 10,000 herons or egrets, killed in a single breeding season, without the stock becoming utterly rooted out. Yet I am told that there is one or more of those sales almost weekly."

The circumstance that birds' feathers are the most beautiful and consequently more valuable at breeding time makes their speedy extermination all the more certain.

"But this sale included also the skins of other birds—mostly, to all appearance, from South America or its islands. Of these there are enumerated 15,574 humming birds, 740 of which are specified as being of one kind, the ruby humming bird. I will not occupy your space by giving details of the rest; sufficient to say that parrots, kingfishers, trogons, tanagers, and various other brightly colored birds are there by the thousand. It may be that the Government of India might take steps, by establishing a close time, to save the herons and egrets from utter extirpation; and the same might be done in our colonies of Trinidad and Demerara, whence I have reason to think that many of the other victims are procured. But the most effectual remedy would be for every rightminded man or woman to discountenance the wearing of feathers on the person or their use in the decoration of furniture."

Mr. Buckland on Crabs.

Mr. Frank Buckland suggests a new way of killing crabs, which we commend to the notice of Mr. Bergh and other protectors of the brute creation. Usually the unfortunate crustaceans are placed in a pot of cold water, which is allowed to heat gradually over a fire, so that the crabs suffer the pangs of a lingering death, the reason for which is that, if at once thrown into hot water, they cast their claws. The proposed mode of painless killing is merely to run an awl or needle through the heart, which is situated in the center of the body, just below the mouth. Crabs, as a general rule, are popularly supposed not to be the most digestible of foods; but Mr. Buckland thinks otherwise. He says that, together with oysters and lobsters, they "should form the diet of all persons engaged in business or literary pursuits where much wear and tear of the nerve power takes place from day to day." No substance conveys phosphorus so readily into the human system, he adds, or assimilates so readily therewith, as the flesh of crustacea.

Effects of Lightning.

The examination by Professor Calladon, of Geneva, of a case of a pyramidal poplar struck by lightning, enabled him to verify some of his previous conclusions, and to add some new observations. The flash which struck this tree, situated 12 yards from the shore of the Lake of Geneva, left perfectly intact the upper portion. At seven eighths of its

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hight commences the trace left by the lightning, in the form of a wound (*plaie*), 1 to 1¼ inches in width and from 2 to 2½ inches in depth. This wound descends as far as the ground, turning round the trunk in the form of a screw, and describing four fifths of the complete circumference of the tree. Fragments of wood of various sizes were projected to distances as far as 50 yards. Some are pierced by jagged holes, indicating a violent eruption of the electric fluid from the interior to the exterior, the track of the fluid having probably been in the layer which separates the alburnum from the old wood or duramen. The places where the emission of the fluid occurred are sometimes indicated by spots of a red color, similar to the effect which might be produced on wood by the application of a hot iron. They correspond to a slight depression of the surface of the wood. The wound of the tree is turned from the shore of the lake, lightning striking more readily plants which grow near watercourses, visible or underground.

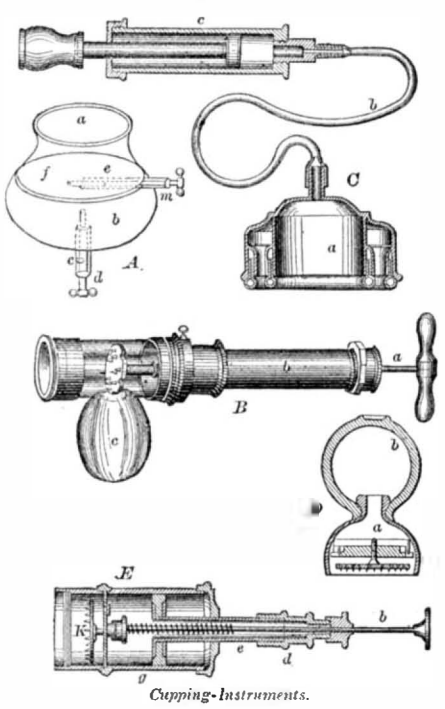
MEDICAL AND PHILOSOPHICAL INSTRUMENTS.

Our extract, this week, from Knight's "Mechanical Dictionary,"* includes descriptions and illustrations of a number of improved surgical and philosophical instruments. One of the oldest

CUPPING DEVICES

known is that described by Hero, of Alexandria, and represented at A, Fig. 1. It consists of a glass vessel, having an

Fig. 1.



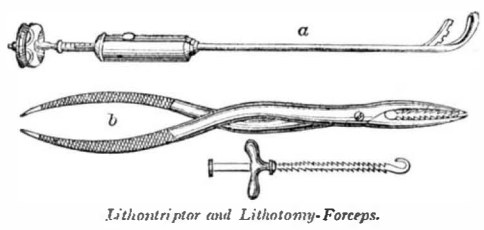
Cupping-Instruments.

inner chamber divided from the former by a diaphragm, *f*. *m* is a valve which governs the opening, *e*, in the diaphragm. The valve, *d*, controls the aperture, *c*, by which the chamber, *b*, is connected with the external air. The valve, *d*, being opened and the valve, *m*, closed, the mouth is applied to the opening, *c*, and a powerful inspiration is taken, rarefying the air in chamber, *b*. The opening, *a*, is then applied to the skin of the patient, and the cupping operation follows. Another apparatus of modern date is shown at B. The glass cylinder has a lip attached suitably for application to the skin. A central rod, *a*, has a disk with lancets which act as scarifiers, and the air is exhausted from the cylinder by means of a piston in the tube, *b*, attached. *l* is the blood receiver. In the instrument, C, the receiver, *a*, is connected by a flexible pipe, *b*, with the nozzle of an ordinary syringe, *c*. The sides of the concentric chamber afford an extended bearing for the cup, and prevent its being driven into the body by the pressure of the atmosphere. In D, the glass has an elastic bulb, *b*, by which the partial exhaustion is effected, and has also an adjustable disk provided with puncturing points to lance the skin. The scarifier, in E, is placed exactly within the hollow piston rod, *e*, which works in a stuffing box on the cylinder, *g*. In using, the air is exhausted from *g* by the motion of the piston, *e*, operated by the handle, *d*. To puncture, the needle bar, *b*, receives a quick downward thrust, forcing the needles on X, into the protuberant flesh within the cup. The spring returns the needle bar and disk into position. The

LITHONTRIPTOR AND LITHOTOMY FORCEPS,

Fig. 2, are instruments for crushing into small fragments

Fig. 2.



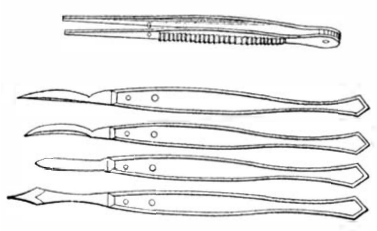
Lithontriptor and Lithotomy-Forceps.

and removing stone from the bladder. The device, *a*, is made in halves, one sliding within the other, and is of the size and shape of an ordinary catheter when closed. It is introduced into the bladder and then, by means of a screw or rack and pinion, worked on the outer extremity, the movable part is made to slide back, thus forming two jaws by which the stone is grasped. By turning the screw or handle, the blade is propelled onward by short jerks, thus breaking the stone into such small fragments that it may easily be voided. The lithotomy forceps, shown at *b*, is used for extracting stone from the bladder through the opening previously made by lithotomy. Its blades are concave and corrugated, and, through their crossed shanks, may be fully opened when inserted, without expanding the wound. Various forms of

DISSECTING KNIVES

are shown in Fig. 3. The forceps, also in the figure, is designed to extend or tighten the flesh at the point of division and to aid in removing divided parts. The shapes of the knives need no special description. The dissection of the human body for purposes of Science was first ordered by Ptolemy Philadelphus, in the college of Alexandria, Egypt, who even authorized the vivisection of criminals condemned to death. Fig. 4 represents

Fig. 3.

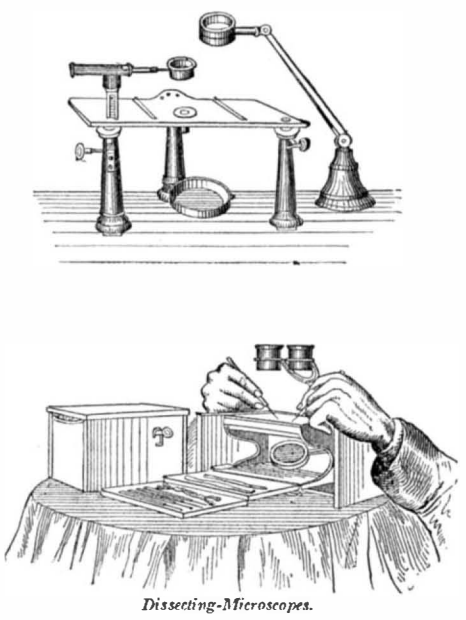


Dissecting-Knives.

DISSECTING MICROSCOPES.

The stage of the upper figure has rack adjustment for focus,

Fig. 4.



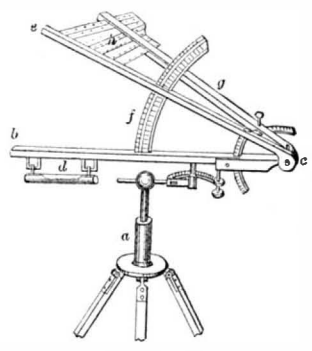
Dissecting-Microscopes.

spring clips to hold object slide, diaphragm, movable arm for carrying the lenses, and separate jointed stand on which any of the sets of lenses can be placed. The lower figure is of a binocular microscope of moderate power. It is made to close up in a box, the top and front of which contain loops to hold the knives, scissors, etc. Beneath the glass is a gutta percha stage and an illuminating mirror.

THE DENDROMETER,

Fig. 5, is an instrument for measuring the hight and diameter of trees, in order to estimate the cubic feet of timber therein. The surveyor elevates the limb, *e*, until that part

Fig 5.



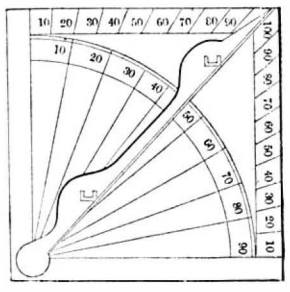
Dendrometer.

of the tree to which the measurement is designed to extend is exactly cut by the line of observation, and the angle subtended between that and the horizontal limb, *b* (which is set by the spirit level), is shown upon the vertical arc, *f*. The gradations on this arc are marks answering to feet and inches of a tangent line extending from the horizontal point upward, taken at a given distance from the tree. The horizontal angles, which are to determine the diameter of the trunk, are ascertained by the limb, *g*, which slides on an arc, *h*, which is marked similarly to *f*. The length of the trunk and its diameter at several parts being thus ascertained, recourse is then had to tables, etc., for finding the corresponding solid contents. The

GEOMETRIC SQUARE,

Fig. 6, is an instrument for measuring distances and hights.

Fig. 6.



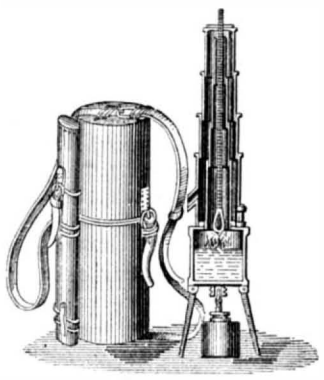
Geometric Square.

It is made 12 or 18 inches square, and the quadrant is graduated in each direction. The two sides opposite to the axial point of the alidade are graduated to 100 equal parts, with major divisions of 10 of said parts. The 100 point finishes at the angle obliquely opposite the center from which the arc is struck. One side represents the horizon, and the alidade with two sights is equal in length to the diagonal of the square. The alidade has divisions equal to those on the sides of the square. In measuring vertical hights, the distance is measured from the station in the base, and by moving the alidade the angle subtended by the object is observed. The

HYPSOMETER,

Fig. 7, is used for measuring hights by observing differences in barometric pressure at different altitudes. This is usually done by noting the boiling points of water. The temperature is shown by a mercurial thermometer with a very large bulb and stem, which has a length of 1 inch for every degree of the scale. This is read by a vernier to 1,000ths. It is found that a difference of barometric pressure of 0·589 inches is equivalent to 1° in the boiling point or 530 feet of ascent at moderate elevations.

Fig. 7.

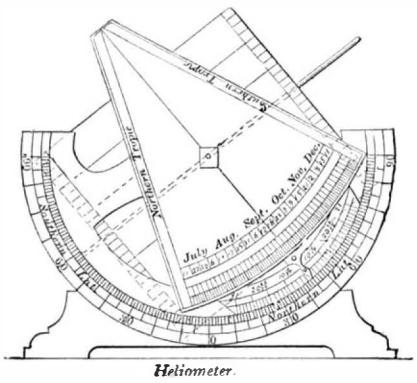


Hypsometer.

THE HELIOMETER,

Fig. 8, serves to ascertain the solar time in all latitudes, and

Fig. 8.



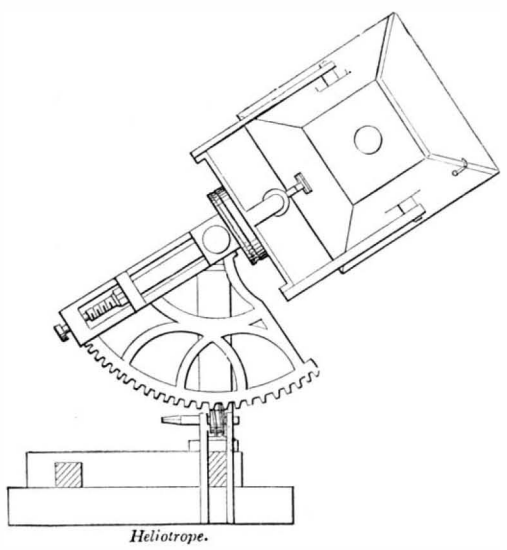
Heliometer.

for ascertaining the latitude when the apparatus is set at noon according to the date. It also is used for finding the date and length of day, sunrise and sunset (other conditions being established), the difference of time between two places, the position of the earth's axis in relation to the level at the point of observation, etc. It does not admit of a brief description.

THE HELIOTROPE,

Fig. 9, is a geodetical instrument used to reflect a ray of light

Fig. 9.



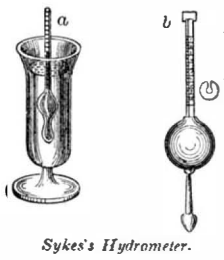
Heliotrope.

to a distant station. That used in the British triangulation has a silvered disk, and has been seen at 100 miles distance, from Cumberland to Ireland. The

HYDROMETER,

Fig. 16, is employed for determining the relative densities of liquids as compared with distilled water. It consists essentially of a float weighted at the bottom so as to keep upright, and having an elongated stem, which in Sykes' instrument, here shown, is graduated into 11 equal parts, which are again subdivided into 22. Eight different weights, numbered respectively 10, 20, etc., to 80 are used in connection with it. The proper weight to be employed depends on the strength of the spirit, etc., to be tested. It is placed on the lower projecting stem, sinking the instrument to a depth corresponding to some one of the gradations on the upper stem. This is noted, and also the temperature of the liquid; and the corresponding strength per cent of spirit is then found from tables constructed for the purpose.

Fig. 10.



Sykes's Hydrometer.

PEAT.—At Clay, N. Y., near Syracuse, the Dodge process for drying and condensing peat into fuel is now in successful operation. $1 a tun is alleged to be the labor cost of production. The specimens we have seen are excellent.

THE French Academy of Sciences has awarded a prize of $4,000 to M. Paul Bert for his original researches on the effect of barometric pressure on the phenomena of animal life.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

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Parisian Toy-Making--Utilizing Waste.

Any one who has ever walked through one of the great toy-importing houses in this city at holiday time, and perhaps wondered at the taste and ingenuity displayed by the French workmen in devising many of the most beautiful playthings, would hardly imagine that waste and refuse materials, very odd ones too sometimes, are largely used in the Parisian toy industry. Elegantly dressed dolls, tricked out in all the refinements of the latest fashion, and which fetch incredible prices on this side of the Atlantic, are frequently costumed from the cast-off stage clothes of actresses in the theatres, purchased for a mere song, or from the useless garments remaining in theatrical wardrobes after a play has had a long run. The coverings of old purses and pocket books, fished out of the gutters by sharp-eyed ragpickers, furnish the material for the doll boot maker. Old sardine boxes and cans yield their plate to the manufacturer of barrels for toy guns. The little wooden or metal wheels which support movable toys are obtained from the refuse of any industry in which articles having circular openings are made. French cruet stands, usually of wood and having holes for bottles, provide thousands of such disks, removed in making the apertures. All the solder and pewter that can be extracted from old roofing and water spouts, or workshop scraps is pressed into service for the manufacture of dolls' knives and forks, tea sets, etc. ; and even the ancient lead coffins dug out of the old cemeteries at Nuremberg, the French toy maker utilizes in the manufacture of lead soldiers. No other nation equals the French in converting the ordinary refuse of the street and workshop into useful and ornamental products. It is this characteristic for saving which makes the French nation so prosperous.

Cooking by Cold.

It is a curious fact, not generally known, that the action of intense cold on organic substances is similar to that of a high degree of heat, and that, when subjected to a very low temperature, meat can be brought to a condition similar to its state when cooked by actual warmth. Quite recently a Hungarian chemist, Dr. von Sawiczewsky, who, it appears, has investigated all the various ways suggested for preserving meat (by chemicals, cooking by heat and hermetically sealing, etc.), and has found points of objection to all, has attempted the preparation of the material by subjecting it in a perfectly fresh state to a temperature of 33° below zero, Fah., and sealing it afterwards in tins. The results obtained have been highly satisfactory; the meat on being removed from the cans appears, in point of smell and color, as fresh as if just taken from the butcher's stall. Although partially cooked, and thus requiring less fuel to complete its preparation for the table, it is entirely without the taste of meat which has been partially subjected to any heating process, and may be roasted, boiled, or otherwise treated, the same as if it were fresh. A commission appointed by the German governments has lately conducted a series of careful and successful experiments upon the process; and as a final test two corvettes of the German navy, being about to circumnavigate the globe, have been supplied with a large stock. An extensive factory is being erected in Hungary for its manufacture.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

PATENT CORSET LOOM.—HUGO CARSTAEDT *vs.* THE UNITED STATES CORSET COMPANY.

The defendant's mechanism does not infringe the first or third claims of the patent. The defendant's take-up is materially unlike the corresponding parts of the plaintiff's machine, and their needle bar is not in combination with the sectional rollers or wheels, which are described in the plaintiff's patent.

The take-up, which is mentioned in plaintiff's second claim, does not mean every kind of take-up, or the take-up in every kind of loom, but refers only to take-ups which are designed for or adapted to the weaving of irregular fabrics.

The plaintiff's needle bar is placed in such relation to the cloth and to the take-up, and by means of such position it is enable to accomplish a result which had previously been unattained in corset weaving.

SHIPMAN, J.:

The patent which is alleged to have been infringed by the defendant was granted to the complainant on March 30, 1869, for an improvement in take-up mechanism for looms for weaving irregular fabrics, and was reissued on November 19, 1872. The patented machine was designed expressly for the weaving of corsets. In weaving articles of irregular size, it is necessary to give greater fullness to one side or portion of the woven articles than is given to another portion. The cloth, notwithstanding this irregularity, is woven in one piece, so that sometimes the weaving proceeds regularly across the whole width of the fabric, and sometimes irregularly across an increasing part of the width. *

The defendant's mechanism is also a take-up mechanism which is adapted to irregular fabrics, but is not sectional in its character. A sectional take-up is one which takes up the cloth only on some parts of the fabric, while the rest remains unmoved; that is, the rolls which are used to take up the cloth are divided in sections, and can be used independently of each other. The defendant's take-up consists of an endless sheet or sheets of rubber, pressing the fabric against a roller. *

It is strongly contended by the defendant that the complainant's needle bar is antedated by the needle bar which is described in the French patent, dated October 2, 1846, to Messrs. Bender, Bandier, and Madame Gobert. The devices mentioned in the patent, and exhibited in the drawings, are somewhat complicated; but the needle bar, which in one part of the specification is styled a rotary bar, seems to have been either a rotary bar or a fixed bar attached to a movable traction box, or traction slide, and not in any proper sense of the word a stationary bar; it did not, therefore, anticipate the bar of the complainant's patent.

As the patent of William P. Brown, and his knowledge and use of the plaintiff's invention, were not set up or referred to in the answer, the testimony in regard to the Brown take-up was not considered.

Let there be a decree for an injunction against the use of the needle bar, and for an account with costs.

[*J. Van Santvoord*, for complainant.
Geo. Gifford, for defendants.]

United States Circuit Court---Southern District of New York.

THE GOODYEAR DENTAL VULCANITE COMPANY AND OTHERS *vs.* EBEN M. FLAGG.

The courts have determined that the construction to be given plaintiff's patent was india rubber, "and the compounds commonly employed therewith reduced to a soft plastic state, capable of vulcanization, and subsequently vulcanized."

In the process described by defendant, he does not use india rubber, or any substance capable of vulcanization. The substance used by him is rendered plastic, and not hardened by heat.

Blatchford, J.

I do not find that any decision has been made in regard to the plaintiff's patent, which gives to it such a construction as necessarily includes the process and substance used by the defendant.

In the Gardner case the defendant did not compound india rubber with sulphur, but he compounded india rubber with iodine, and he employed heat to harden the rubber (Goodyear Dental Vulcanite Company *vs.* Gardner, 4 Fisher's Patent Cases, 224, 231.)

In the Smith case the view of the court was that the material to be used under the plaintiff's patent in carrying out the invention patented was to be india rubber, "and the compounds commonly employed therewith reduced to a soft plastic condition, capable of vulcanization and subsequently vulcanized." Goodyear Dental Vulcanite Company *vs.* Smith, 5 *Official Gazette* of Patent Office, 585.)

It appears from the description of the process used by the defendant in this suit that he does not use india rubber or any substance capable of vulcanization; that the substances he uses is one which is rendered plastic by heat, and is not hardened by heat; that heat is used in the process to soften the substance, and render it plastic, and not to harden it, and that the substance, after being molded, is hardened by being cooled. It is not sufficiently clear that this process is embraced in the claim of the plaintiff's patent to warrant the granting of an injunction until one is awarded as the result of a decree for the plaintiffs on final hearing.

[*E. N. Dickerson* and *B. F. Lee* for the plaintiffs.
W. D. Shipman, *C. A. Seward*, and *E. Luther Hamilton* for the defendant.]

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED STONE-DRESSING AND SAWING MACHINE.

Silas Steinbeck, Chicago, Ill.—This invention consists of rotary sawing and surfacing cutters, having recesses or notches of peculiar form, to admit the sand between them and the stone; and it also consists of improvements in means for feeding the sand to the cutters, which consist of a slowly rotating screw, which throws the sand over the edge of the trough on to conductors down which it flows to the stone at the cutters.

IMPROVED SPRING MOTOR.

Edwin Lambkin, Sebewaing, Mich.—This is an improved spring power for running street cars, railroad hand cars, road vehicles, and driving machinery. The invention consists in the peculiar construction of a spring drum, and in means for applying a brake and operating a shifting mechanism, the whole of novel and ingenious construction, but hardly possible to explain clearly without the aid of drawings.

IMPROVED CROSSCUT SAW HANDLE.

Samuel Boone, La Gro, Ind.—We have here an improved mode of attaching saw handles to the saw. There is a ferrule, with a perforated rubber block in the closed end thereof, a saw-binding clamp-piece, which is securely attached to the handle by a binding block, with saw-fastening clamps, and a shank with threaded end that extends into a perforation of the handle to be screwed thereon. A rubber cushion and washer at the bottom of the ferrule produces the secure attachment of handle to ferrule and block. The saw is recessed both at the back and side edge, to apply the handle longitudinally or at right angles to the saw.

IMPROVED BACKLASH SPRING.

Thomas Alsop, Elkhart City, Ill.—This inventor proposes a new back lash spring for mill spindles, shaftings, etc., which bears equally on the pinion at both sides of the shaft, and takes up the backlash uniformly throughout the whole length of the spring. The invention consists, mainly, of one or more springs, coupled together and applied at one end by a fixed sleeve or clutch to the shaft, and at the other end to a loose disk that engages, by stops or pins, the pinion that transmits the power to intermeshing gearing. The springs are rendered durable, as no friction or tensile strains are exerted thereon.

IMPROVED SAW GUMMER.

Jason W. Mixter, Templeton, Mass.—This inventor now improves on the saw gummer for which letters patent have been granted to him under date of June 23, 1874, so that the carriage, which is formed with a quadrantal slot at each end, is allowed to swing freely upon screws which pass through said slots and enter the main frame, admitting thereby the changing of the line of cut from the horizontal to the perpendicular without moving the cutter from its place, and without necessitating the readjustment of the machine.

NEW AGRICULTURAL INVENTIONS.

IMPROVED BEE HIVE.

William L. Hamilton, Glasgow, Ky.—This bee hive is provided with the latticed frames, working in and out of the upper chamber on slides, and held detachably together by wires, to be opened readily for taking out the honey.

IMPROVED HAY RAKER AND LOADER.

George Lambert, Hill Grove, O.—This is a new machine for gathering hay and loading it upon a wagon in a compact form. The hay is elevated by an endless apron having cross bars and swinging arms with spikes to collect the hay. Guides raise the arms from a horizontal to a vertical position as the apron lifts the hay, thus compressing the same.

IMPROVED PLOW HANDLE.

William A. Couch, Hannibal, Mo.—This is an open work metal handle, easily attached to the upright of the plow stock by a single bolt. The novelty lies in the construction, which is such as to ensure strength as well as lightness.

IMPROVED GANG PLOW.

Enoch C. Eaton, Pinckneyville, Ill.—This invention includes several new and ingenious devices by which the plows can be readily adjusted to work deeper or shallower in the ground, which will hold the plows from lateral play when at work. Suitable new arrangements also enable the plows to be easily raised from the ground.

IMPROVED GUANO DISTRIBUTER.

Richard A. Barrett, Newsome Depot, Va.—This relates mainly to combining with the distributing cylinder an axle having long journals, frame bearings, flanges, and nuts. When nuts are screwed up, the distributing cylinder is compelled to turn with the axle; but when the nuts are loosened, the weight of the distributer will hold the axle still while the wheels revolve upon its journals.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED REFRIGERATOR CAR.

Arnold W. Zimmerman, Denison, Tex., assignor to Samuel Pillsbury, New York city.—This inventor has devised a new refrigerator car for preserving fresh meats, vegetables, and other perishable articles while transporting them over great distances. There is an ice receptacle at the top of the car, provided with flat top and curved and inclined bottom. Above the ice receptacle an air space is formed, that communicates, by side spaces, with the main part of the car, for conveying the warm air and vapors to the ventilators above the air space. The condensed moisture is collected by a longitudinal inclined trough below the lowest part of the ice receptacle, to be conveyed to the outside. The ice water of the receptacle is drawn off by end pipes and stop cocks.

IMPROVED SHAWL STRAP.

Frederick Turner, Frankford, Phila., Pa.—This consists in a combination of straps with a handle, which terminates at each end in a spring hook for connecting the straps, so that they can be connected and disconnected readily. It also consists in the combination of a cross bar, having a hook, with the handle and strap.

IMPROVED SPRINKLER.

John C. Melcher, Black Jack Spring, Tex.—This is a short drum, with the inlet for receiving the water on one side and the orifices for discharging the water on the opposite side. The device has the effect of causing the water to emerge in solid jets, capable of reaching over a wide range of area.

IMPROVED CENTER BOARD.

William Austin, Apalachicola, Fla.—These center boards do not differ from the usual single center boards, except they are each placed obliquely to, instead of parallel with, the keel of the vessel or boat. By virtue of the angle at which the center boards are placed the vessel is set to windward, and made to run much closer to the wind than vessels having the ordinary center board.

IMPROVED SPARK ARRESTER.

Royal P. Faries, Wichita, Kas.—This consists of a wire netting section in the smoke stack for the escape of the smoke. The cinders are allowed to pass above into a trap formed by a close cover over the pipe and a contraction of the top of the latter, from which they are conducted back into the smoke arch through pipes passing down the side of the smoke pipe through the saddle.

IMPROVED SCHOLAR'S COMPANION.

William A. Harwood, Brooklyn, N. Y.—The object of this invention is to provide for use of school children a pocket companion or case for pencils, pens, etc., which shall possess a shape best adapted to enable it to withstand the rough treatment to which it will ordinarily be subjected in actual use, and to prevent rapid wear of the pocket in which the case is carried. The box is formed of a single sheet of tin, bent to form rounded sides, the bottom being nearly flat. The ends are formed of separate pieces of conical forms, and are fastened on said body so as to inclose its ends. The cover is a mere strip of tin with parallel edges, and is fitted to slide forward and backward in grooves.

IMPROVED MUZZLE.

August Miller, Salina, Kas.—This is an improved muzzle for calves, by which they can be effectively prevented from sucking the cows when in the same inclosure with them, without being hindered from grazing or getting other food. A full top muzzle frame with a swinging front plate has hinged and spurred side plates, the whole being attached to the head by suitable fastening straps. The swinging side plates have inward projecting catches, that bear on the top frame, and prevent the front and side boards from swinging away from the mouth.

IMPROVED LIFTING JACK.

Samuel E. Mosher, Chillicothe, Ohio.—This is an improved lifting jack, which may be made entirely of cast iron, and adjusted to any suitable hight to support the weight to be lifted in a safe and reliable manner. A hollow standard guides a tubular and toothed lifting bar, into which the toothed and lever acted block enters that raises the lifting bar to support the same on differential toothed spring pawls at any hight. The actuating lever is made of two sections, fulcrumed to oscillating pieces of the main standard and pivoted to the lifting block.

IMPLEMENT FOR FORMING BARBS ON WIRE FENCES.

James H. Hill and William H. Jayne, Boone, Iowa.—This is an improved implement for forming barbs upon the wires of a wire fence easily and quickly, and in such a way that the barbs will retain their places securely. By suitable construction the barbs are firmly twisted around each other and around the fence wire.

IMPROVED HAIR RESTORATIVE COMPOSITION.

Mrs. Anness R. Kinyon, Downer's Grove, Ill.—This improved restorer consists of extract of wild grape vine, with which is combined salt and castor oil, to cleanse and heal and prepare the scalp for the restoring properties of the grape vine. The alcohol is combined in sufficient quantity to cut the oil and keep the preparation sweet.

EXTENSIBLE FRAME FOR WINDOW SCREENS, ETC.

John R. Simpson and George W. Simpson, New York city.—This improved frame, though designed especially for a fireboard frame, may be used for a window screen frame. It is so constructed that it may be readily expanded and contracted, to adjust it to fireplaces and windows of various sizes.

IMPROVED BOILER TUBE STOPPER.

Peter Walker, Jersey City, N. J.—This consists of a spring packing ring and a clamp for expanding it for each end of the boiler tube. The clamps are formed of a collar on each end of the tube. Other collars on a rod pass through the tube, and are fixed so as to clamp and expand the packing rings tightly into the tubes of the boiler. The rod and tube of the stopper are of suitable length to fasten the packing rings into the tube at the ends. A stopper of this kind can be put in a locomotive or marine boiler, by the aid of suitable tools, without stopping the fire.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DUMPING WAGON.

Jacob Kramer, New York city.—This is a dumping wagon having the seat mounted upon the front truck, and the body hinged at or about the middle thereof to the rear axle, whereby the rear axle bears the greater part of the load, and the body turns clear of the seat.

IMPROVED WHIFFLETREE.

Remus D. Hale, Transitville, Ind.—This consists of a dovetail-shaped projection on the under side of the whiffletree sliding into a corresponding grove in the top of a stud pivoted in the evener, and fastening by a snap spring, so as to be easily and quickly connected and disconnected.

NEW HOUSEHOLD ARTICLES.

IMPROVED COFFEE POT.

Louis C. Lomer, New York city.—In this coffee machine a liquid-holding vessel (provided with an internal arrangement of strainers and a discharge pipe leading from the bottom thereof) is supported in or upon a detachable stand or pedestal. The improvement relates particularly to the construction of the stand, which has semi-circular hinged covers, which are left open while the alcohol is burning, and closed to extinguish the flame.

IMPROVED DOOR AND GATE SPRING.

Levi Gallaher, Businessburg, Ohio.—This spring is so arranged as to throw back the gate whenever the latter is opened only sufficiently to allow passage through. When the gate is pushed open more widely, devices prevent the action of the spring.

IMPROVED IRONING TABLE.

John L. Young, Foxburg, Pa.—To this improved ironing board the shirts may be readily applied, and then securely retained in stretched state for ironing. There is a dovetailed recess at one end, to which the collar band is attached by a fastening key, and also a dovetailed stretching block, to which the lower part of the bosom is keyed. The block is guided in the recess at the opposite end of the board by a projecting bottom edge, and locked to the ratchet teeth of the recess.

IMPROVED BOILER WASHING MACHINE.

William B. Rodeckerand Frank C. Pifer, Eureka, Ill.—This invention relates to the arrangement of parts, whereby the clothes are turned in the cylinder and prevented from becoming packed too closely against the sides thereof; also, whereby the cylinder is held in the middle of the boiler.

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A good price will be paid for Scientific American for July 2, 1870, and February 7, 1874, by W. W. Stapler, Wilmington, Del.

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American Metaline Co., 61 Warren St., N.Y. City.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

R. J. W. can prepare gun cotton by following the formula on p. 282, vol. 31. Cone pulleys can be proportioned by the rules given on p. 180, vol. 26.—F. K. will find a recipe for cement for grindstones on p. 251, vol. 31.—W. C. will find a description of the manufacture of bicarbonate of soda on p. 125, *Science Record* for 1875.—W. N. can proportion his safety valves by the formulæ given on p. 363, vol. 29.—W. & Co. can produce a fine black finish on German silver by using the method described on p. 288, vol. 31.—W. J. W. will find directions for gilding with leaf gold on p. 347, vol. 31.—J. F. Y. will find a description of salicylic acid on p. 96, vol. 33.—C. F. M. will find directions for refining cotton seed oil on p. 11, vol. 32.—J. E. J. will find directions for calculating the horse power of an engine on p. 33, vol. 33. This also answers J. McD. A cement for fastening leather on pulleys is described on p. 42, vol. 26.—T. H. S. can blue iron by the process described on p. 123, vol. 31.—B. S. S. will find directions for melting small quantities of brass on p. 54, vol. 31.—F. P. will find a good recipe for black ink on p. 92, vol. 33.—W. H. Jr. will find a recipe for marine or waterproof glue on p. 42, vol. 32.—J. M. C. will find directions for gilding on marble on p. 59, vol. 30.—R. A. E. will find some excellent directions for painting carriages on p. 308, vol. 33.—W. A. McG. will find a recipe for yeast on p. 183, vol. 33, and one for baking powder on p. 123, vol. 31.—B. W. S. will find directions for laying out a wind wheel on p. 241, vol. 32.—H. B. will find a recipe for aquarium cement on p. 80, vol. 31.—O. C. L. will find directions for producing the Etruscan finish on gold on p. 363, vol. 33.—P. W. will find an answer to his query as to sizes of boilers on p. 43, vol. 34.—A. B. will find a description of Pharaoh's serpents on p. 315, vol. 32.—R. T. W. will find a recipe for indelible ink for stamping on p. 129, vol. 28. This also answers A. F.—W. P. will find directions for painting outdoor work on p. 409, vol. 31.—W. L. S. will find full directions for burning coal dust economically on p. 107, vol. 32.—If O. Y. will read the SCIENTIFIC AMERICAN regularly, he will not waste his time over the perpetual motion nonsense.—N. R. H. will find a recipe for a dipping acid on p. 139, vol. 31.—H. R. will find directions for making a tar concrete sidewalk on p. 50, vol. 32.—C. R. will find directions for enameling the insides of iron vessels on p. 362, vol. 32.—E. D. J. will find a description of a depilatory on p. 362, vol. 32.—W. K. will find a recipe for scarlet ink on p. 200, vol. 30.—C. W. can fireproof shingles by the method described on p. 280, vol. 28.—F. R. can tan skins with the fur on by the process described on p. 233, vol. 26.—C. J. can preserve wood from decay by the process detailed on p. 319, vol. 31.—W. D. will find directions for making plaster of Paris on p. 399, vol. 29.

(1) D. L. says: 1. I wish to construct a magic lantern for parlor use. I have a pair of 3½ inch condensers, and I want to know if the object glasses of a large opera or field glass will do for the magnifying lens. They are two inches in diameter, and achromatic. A. Yes. 2. I have also a compound microscope. I should like to throw objects from it upon a screen. Can I attach it to my lantern? A. By using the lowest power objective you have, without the eyepiece, and placing it and the object in the most concentrated portion of the light, you may be able to get a small projection if your light is good. See p. 101, vol. 34.

(2) S. A. asks: 1. Can you give me a recipe for a lead glazing that will stand a white heat for hours? A. The lead glazings are all characterized by their easy fusibility. You will have to look in some other direction for so refractory a glazing as you describe. 2. Has there ever been any instrument for testing the heat used in burning stoneware? A. Yes, various forms of pyrometer have been employed for this purpose. See p. 130, vol. 24.

(3) G. S. T. says: In walling wells with timber, I find that the wood renders the water unwholesome. Is there any remedy for it? A. Yes, char the wood on its surface.

(4) C. T. C. asks: 1. Is it true that benzine will dissolve india rubber? A. Benzine dissolves caoutchouc but sparingly in the cold. Bisulphide of carbon is the proper solvent, but it also dissolves readily in hot naphtha. 2. Can india rubber be colored? A. Yes, by means of the aniline dyes. 3. Will the benzine, when the solution is exposed to the air, evaporate and leave the rubber? A. If an object be covered with either of these solutions as a varnish, on exposure to the action of the air the solvent will evaporate, leaving behind the rubber as a thin pellicle.

(5) G. P. W. asks: What proportion of fish glue shall I mix with common glue in making belt cement? A. Use 2 ozs. isinglass to every 4 ozs. of glue.

(6) M. H. K. asks: We solder rings with various kinds of precious stones in them, with hard solder, by placing them on a block of metal while blowing on them. I claim that the success of the operation is due to the mass and the conductivity of the block of metal, and that therefore the best conductor of heat of equal size is the surest. A friend contends that it is the mass alone, and that the poorer the conductor of heat, the better. Please state which is right. A. The mass and its conductivity should both be taken into consideration.

Which will preserve ice the longer, of two vessels of equal size, etc., one which is kept free from the water that results, or one which the water fills up, mingling with the ice? A. The former.

(7) J. McC. asks: What will prevent aniline red ink from fading? A. This cannot be remedied. Use some other coloring matter.

(8) G. E. E. says: I send you a specimen of graphite. It is at present impure. Is there any process for purifying it? A. No. 2. Does a large deposit of it indicate the neighborhood of coal, lead, or emery? A. No. 3. Considering the enormous consumption of plumbago, and the working out of many graphite deposits, is an immense mine of it likely to become of any value? A. Yes.

(9) R. R. asks: 1. What will prevent the colors running when carpets are washed? A. Carpets whose colors are not properly mordanted or fast cannot be washed without injury.

How can I make a liquid ink eraser? A. Oxalic or hydrochloric (dilute) acids, and sometimes cyanide of potassium, are employed for this purpose.

(10) S. C. D. asks: 1. What apparatus is necessary for measuring the indices of refraction and dispersion of a specimen of optical glass, for calculation of curvature for grinding correct lenses? A. It requires a circle graduated into degrees and minutes, upon which is mounted a telescope similar to the theodolite, with cross wires in the eyepiece. A small table is attached to the objective end, so as to move with it: a narrow vertical slit illuminated by sunlight is placed 10 or 15 feet distant from the instrument. The telescope is then turned on the slit, and the position read off. Then a prism (made of the glass you wish to try, whose angles are known, is placed upon the table in front of the objective, and the telescope turned so that the solar spectrum is seen at the position of smallest deflection: and then the position is again read. From this the index of refraction is determined. The dispersion is found by observing the fixed lines of the spectrum. 2. Should the edges of the disks be finished before or after grinding the lens? A. After. 3. How is the roughing out for lenses of short radius (concave) done, before applying the tool? A. The convex sides may be shaped by grinding off the edges on a flat tool until it nearly fits the templates. The concave side is ground on convex tools. Opticians who have different tools use those of longer curves first.

(11) M. R. C. S asks: 1. How can I cover small twigs, leaves, and gauzy textile materials with crystals resembling frost or ice? A. Hot concentrated solutions of gum arabic, white sugar, alum, and chloride of ammonium (sal ammoniac) are employed to produce these effects. 2. How can I produce the appearance of icicles? A. Icicles may be imitated by means of pure gelatin (isinglass).

(12) F. W. B. says: I have made some attempts to manufacture sal soda from soda ash, by putting into boiling water all the soda ash it will take up or dissolve, carefully skimming off all the scum that rises, then taking it off to cool; but before it begins to crystallize, I carefully turn it off and leave the sediment. This I repeat three times, and get a clean and clear crystal, but there seems to be quite a waste in the dark sediment left. Is this the best way to make sal soda? A. Crush the crude soda ash into small pieces and calcine in a reverberatory furnace along with a quantity of fine sawdust. Digest the refined ash for some time with clean, hot water (not boiling), draw off the clear liquid into rather shallow troughs, and, by means of a proper ladle, remove the crystal from time to time. The residue is treated to recover the sulphur.

(13) McC. Bros. ask: What substance, when mixed with cane tops and corn tops (out of which and mold a compost has been made) will rot or decompose the said tops, and thus give us a valuable manure? A. Disintegrate the vegetable fibers of the cane tops as completely as practicable, and treat with a suitable quantity of good lime. Sulphate of lime will not answer.

(14) M. L. W. asks: 1. What is the chemical composition of the mineral witherite, and what are its uses in the arts? A. Witherite is a carbonate of baryta. In 100 parts it contains: carbonic acid 22·3, baryta 77·7. It is used in chemical works, in the manufacture of plate glass, and in France in the manufacture of beet sugar. It is also employed in the production of the rarer salts of barium. 2. Are any deposits of it found in this country? A. It is not of common occurrence in the United States, but is found in considerable quantity near Lexington, Ky., with barite.

(15) J. A. H. says: The carrying boards under flour reels are flat, and consequently, in cold weather, with hot air inside and cold air outside, moisture forms on the boards and clogs them with flour. Can you give me a recipe for a varnish that will retain its gloss under these disadvantages? A. Varnishing them would not rid you of the annoyance. It will be necessary for you to jacket them with some non-conducting substance, so as to equalize as far as possible the immediate interior and exterior temperature of the boards, and thus prevent the precipitation of the moisture from the warmer air within.

(16) J. W. T. asks: What are the relative velocities of three planets whose orbits are to each other as 15, 19, and 12, in times which are to each other as 7, 3, and 5? A. If we understand the question aright, the answer will be

15	19	12 multiplied by
7	3	5 respectively.
—	—	—
105	57	60

(17) F. G. H. asks: Will malleable iron rust when in water, or when exposed in a damp place? A. Yes.

I would like to know of a good process for tinning malleable and gray iron castings. A. Pickle your iron castings in oil of vitriol, then immerse them in muriate of zinc (made by putting in muriatic acid as much zinc as it will dissolve), and then dip them in a mixture of 3 parts tin and 1 part lead.

(18) G. W. S. asks: A friend contends that a locomotive exerts a greater power when the crank is on the bottom center than when it is on the top. I say there is no difference. Which is right? A. You are.

(19) M. H. says: I wish to build an oven for heating wagon tires. Can you give me an idea how to make it? A. Build a circular trough with a fireplace on one side and the chimney over the top of it. The roof may be about 12 inches from the top of the trough, and should be of bars of iron, supporting bricks. In heating the tire, keep it covered all over with wood or charcoal, and revolve it in the fire as usual.

(20) C. W. L. C. asks: 1. At what speed shall I run a smooth disk to saw cold iron and steel? A. About 25,000 feet per minute. 2. What shall I use for belting to drive it? A. Leather.

(21) W. E. D. says: I have been using a steel mill for milling brass screws. It was made of round bar steel ½ inch in diameter, with a $\frac{3}{16}$ hole drilled in lengthwise to the depth of 1½ inches. While using the mill, it became heated by friction, and I cooled it by pouring water on it. While turning up a screw, the mill exploded with a sharp report: at the same time a puff of steam came out from the hole; it blew out a piece nearly ½ inch long and about ⅛ the size of the mill. Wha was the cause? A. Some of the water used in cooling remained in the hole, and the heat vaporized it; the pin fitted the hole too tight to allow the steam to escape, and hence the explosion.

(22) N. S. B. Jr. asks: 1. What kind of wood will make the best sled runners? A. Lance wood. 2. How shall I bend them? A. Boil them in water. 3. I have a pair of red ash poles 1 x 1⅛ inches, which I wish to make into runners by bending them up the 1⅛ inches way. Can I do so safely by boiling them in water for 4 or 5 hours? A. Yes.

(23) C. says: We are building a steamboat for hunting and fishing purposes, to carry a party of 10 or 12. She is to be 50 feet long, 10 feet wide, with 24 inch gunwales, with a flat bottom, and she must not draw over 8 to 10 inches water. Could a propeller be used in so little water, or should side wheels be used? A. Side wheels would be preferable for this case. Make them as large as convenient, if they have fixed floats. 2. What size of portable engine with horizontal boiler is necessary, and what size of side wheels, to attain 5 or 7 miles per hour up stream? A. If a portable engine is used, it will be necessary to introduce gearing, so as to get the proper speed for wheel shaft, in which case an engine rated at 15 or 18 horse power will probably answer, if sufficient boiler be given her.

(24) W. L. McG. asks: What has become of the report of the commission appointed by Congress for ascertaining the causes of explosions of boilers? A. The commission that made the experiments last season has decided, we believe, to keep them private until the whole series is complete.

(25) S. D. P. Jr. says: In operating a steam boiler, the firemen keep a bed of coal about 10 inches deep. They claim to save coal over the plan of working a lighter bed, for the reason that it does not require stirring up so often, and there is, in consequence, less waste of coal through the grate. I will add that the draft is not very strong. The boiler is 4½ x 12 feet, with 71 three inch flues, in brickwork setting. A. It is difficult to give a general rule, as much depends upon the draft, the kind of fuel, etc. But if you have any doubts in regard to the correctness of your firemen's views, you can settle the matter conclusively in a very short time, by experimenting with fires of different thickness.

(26) J. L. G. asks: Would it be practicable to set a boiler 500 yards from the engine, packing the pipes in sawdust? A. It can be set at this distance, if careful provision is made for draining the pipes.

(27) A. C. asks: Will 16 sticks, each 1 foot in diameter and 8 feet long, make a cord? In other words, what is the legal rule for measuring round timber? A. If you are buying the logs as timber, the general rule among lumbermen is to compute the cubic contents according to what the logs will square. In the case of cord wood, there is so much difference of opinion among measurers, and such variety in the decisions of the courts, that it is not possible to tell you what the legal rule is.

(28) R. D. says: I can take apart, put together, and run one form of engine, but have had no experience with any other. If I applied for a license to run such a one as I understand, would I be examined on engines generally (of which I know but little) or for the one I want to run? A. The examination is generally intended to test the candidate's knowledge of the particular boiler and engine of which he desires to take charge.

(29) A. S. says: I am informed that to measure the capacity of a vessel I should weigh the water it will hold, and that for every 8 lbs. of water it will hold a gallon of liquid. Is this so? A. This rule will give a rough approximation. At ordinary temperatures, the weight of a United States gallon of water is about 8·32 lbs.

(30) C. R. says: A 10 inch pipe is laid on an incline 300 feet long, and then a 20 inch pipe on the same incline. If we put a plug or a fire hydrant on each pipe, give them the same opening, and put the same sized nozzle on each, which nozzle will throw the farther? A. The hydrant on the 20 inch pipe should throw a little the farther under the circumstances, because the head required for velocity and friction would not be as great as in the case of the 10 inch pipe.

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(31) J. L. W. asks: How can I prevent the twisting of belts? A. By using a good quality of belting, setting the pulley true, and lacing the belt even and straight.

(32) G. W. G. says: 1. I am about building a steam yacht 36 feet long and of 7 feet beam. Are there any objections to using iron for the hull? A. We see no objection to using iron. 2. Of what thickness should the iron be? A. About ⅛ of an inch thick, or less. 3. Would galvanized iron be the best? A. Galvanized iron will be best on many accounts. 4. Would it be advisable to use side wheels? A. If the boat is to be generally run in smooth water, side wheels will answer well.

(33) J. B. F. asks: What shall I use on the point of a small drill to prevent it from clogging and heating, in boring copper, silver, and gold? A. Lard oil.

(34) R. B. says: I sent you last June the dimensions of a tow boat I was building. At her first trial trip we started out with 65 lbs. of steam, and made the run of 2 miles in 11 minutes, the propeller making 109 revolutions per minute, and the steam being cut off at $\frac{9}{16}$ of the stroke. She has a been running and towing ever since, and has proved herself to be one of the best boats in Baltimore. She has towed a three-masted schooner, laden with 750 tuns of coal, 20 miles in 3½ hours, and made the run back in 2 hours. She has a 16 x 16 inch square cylinder. Her dimensions are as follows: Length 60 feet over all, width 14 feet, depth of hold amidships 7 feet. She draws 7 feet 4 inches water aft and 4 feet forward. Her propeller is 6 feet in diameter. She cost about $9,000, complete. A. You seem to have a very satisfactory and powerful boat. We are much obliged for your letter.

(35) F. M. L. L. says: What kind of power is best for operating coal-mining machines? A. Compressed air or steam.

(36) F. W. B. says: Wishing to build a dam and to put up a mill, and having on hand a 24 inch turbine wheel, I desire to learn if, by suitable gearing, I can use the wheel for the small amount of work to be done, say not over 5 hours grinding per day, or from 20 to 30 bushels? The head of water is from 20 to 25 feet. A. As you have a wheel that can exert more power than is needed, you will scarcely experience much trouble in reducing the effect somewhat.

(37) E. B. asks: What is the best method of straightening stencil plates, after cutting the letters, so that they will lay flat on the work? A. Place each plate on a large block of wood, then straighten it with a small block of wood and a light hammer.

(38) S. K. J. says: In your issue of January 1, you speak of the conductor in Mr. Edison's experiments not requiring insulation, and say that it may be wound round large bodies of metal. Will these bodies of metal, round which it is wound, yield the spark? That is to say, will the "etheric" fluid leave its conductor and pass to the mass of metal, and can the spark be obtained from the mass? So also in the case where it has trailed along the ground, or in the water: can the spark be obtained from the ground or the water? Its practical application depends on this very important point. A. It is now generally believed that the "new force" referred to is electricity, consequently it should be subject to electrical laws. Provided insulation is good, we would, therefore, expect to obtain sparks by induction from the bodies about which the wire is wound.

(39) W. K. asks: What is the best remedy for leaks round the flues and seams of a steam boiler? A. Caulk the leaks.

(40) J. H. L. asks: 1. How are the electro-magnets in the Gramme magneto electric machine wound, to make the poles come in their centers? A. The armature coils are wound separately, the inside end of one coil being connected to the outside end of the one next following. Wires also lead from the junctions to strips of metal attached to a cylinder of some insulating substance. The latter is placed on the armature axis. The coils, for what are called the "field magnets," are all wound one way, but the connections are so arranged that north and south poles come on opposite sides of the armature. If coils with like ends pointing in one direction are put on a magnet, similar poles will be produced at opposite ends of the latter when the inside ends of the coils are connected together and the outside ends joined to a battery. 2. Why could not the frame and magnets be cast in one piece, making the magnets of cast iron? There would be no work on this part but to bore out the journals and cover parts intended for the electro-magnets with copper, thus saving considerable cost. A. They are now made that way.

(41) R. B. asks: Which is the correct way to connect a throttle valve on an engine, that is, which end of the valve should take the steam first? A. The steam should enter on the underneath side of the valve, so that it can be packed whether the steam is on or off.

(42) J. N. P. says: In an article in your issue of January 29, the writer claims that the breakage of band saws is due to the saw being obliged to turn a wheel or pulley, which causes friction, straining of the saw, etc. Could not that be very easily remedied by turning the pulleys by a mechanical movement, independent of the suw? A. The device mentioned is already in use. Another and a beautiful device supplies the supplementary outer rim on the upper or loose pulley. The friction of the supplementary rim is sufficient to turn the loose or upper wheel. But when the lower or driving wheel is stopped suddenly, the upper or loose wheel turns inside of the supplementary rim, which effectually prevents the sudden jerk on a thin narrow blade, which causes most of the breakage. Another device is to belt from the shaft of the driver to that of the upper or loose wheel shaft, so that, when the lower shaft is suddenly stopped, the belt stops the upper one also.—J. E. E., of Pa.

(43) L. R. asks: What is the best substance as a non-conductor of heat, which can be packed in a cavity in iron? A. A mixture of ⅔ plaster of Paris and ⅓ alum is a good one.

(44) O. H. Y. asks: What is the fastest speed at which it is safe to run circular saws? A. Nine thousand feet per minute, that is, nearly two miles per minute, for the rim of a circular saw to travel, may be laid down as a rule. For example: Run a saw 12 inches in diameter, 3 feet around the rim, at 3,000 revolutions; 24 inches in diameter, or 6 feet around the rim, at 1,500 revolutions; 3 feet in diameter, or 9 feet around the rim, at 1,000 revolutions; 4 feet in diameter, or 12 feet around the rim, at 750 revolutions; 5 feet in diameter, or 15 feet around the rim, at 600 revolutions. Of course it is understood that the rim of the saw will run a little faster than this reckoning, on account of the circumference being more than three times as large as the diameter. Shingle and some other saws, riveted to a cast iron collar or very thick at the center and thin at the rim, may be run with safety at a greater speed.

(45) E. D. E. asks; 1. What is the smallest shaft, 14 inches in length, that I can put in a steam engine, the crank being 2 inches long and the pressure on the end 600 lbs.? A. Use a 1½ inch shaft. 2. What is the best iron for the purpose? A. Low Moor iron or Ulster iron.

(46) G. B. C. asks: Can you give me a good recipe for lathe cement, for holding small articles? A. Use beeswax 1 oz., resin ½ oz., pitch ½ oz.; melt, and stir in fine brickdust.

(47) D. L. R. asks: After a current of electricity has passed through an electro-magnetic engine and done its work, what becomes of it? Does it not pass on in its circuit? If it does, why will it not run another engine of same capacity? A. The energy is absorbed in performing the work.

(48) G. S. D. asks: 1. Will a magnet, placed near a piece of iron or steel, impart its magnetism to the iron and steel to that extent that an equilibrium between the two bodies will take place, and so that neither will have any power to attract the other? A. No. If the iron or steel is free from magnetism, there will be attraction; if not, there will be attraction or repulsion: attraction when unlike poles are opposed, repulsion in the opposite case. 2. Will an artificial magnet always retain its magnetism in full force, without any loss from any cause? A. No, unless special precautions are taken with regard to it. 3. Is an artificial magnet as strong as a natural one? A. Artificial magnets can be made with power greatly exceeding that of natural magnets.

(49) T. P. says: Joshua Rose writes the most interesting articles in your journal. This makes it a pity that he should say that, to divide the circumference of a circle into 60 equal parts, "we have only to divide the radius of our circle into 10 equal parts to get the required distance." A. In "Practical Mechanism," No. XLI, the division of the radius of a circle was given as an aid to setting the compasses approximately; it was not intended to imply that by such a rule the compasses could be set correctly to the exact distance. We are obliged to T. P. and other correspondents for calling our attention to the matter.

(50) W. S. says, in reply to J. B. R., who asked for a solution to clean articles after brazing: I have succeeded by dipping, while hot, into a dilution of sulphuric acid in water.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. H. S.—It consists mainly of sesquioxide of iron and silex.—R. B. J.—It is argentiferous galena.—S. P. W.—Write to Professor C. D. Cope, Corresponding Secretary of the Academy of Natural Sciences, Philadelphia. The petrefied wood is not rare enough to be of much value.

S. asks: What amount of flour of both grades is contained in a bushel of good wheat, and how much bran and other refuse?—H. V. says: We get from a cow milk of which the cream is of a light red color, as if there were blood in it. Can any one tell me the cause and the remedy?—G. W. C. asks: How can I repair a rubber comb?—S. asks: Is there any veterinary college in America?—H. G. H. asks: How can I make the flexible composition of which toy heads are made, which looks somewhat like vulcanized rubber?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Ocean. By C. O.
On Spontaneous Generation. By S. R.
On Cleaning Chimneys. By W. P. E.
On a New Motor. By A. F. G.
On the Mississippi Jetties. By E. G. F.
On the Life of Matter. By J. R.
On a Pneumatic Tube and Carrier. By A. B. H.

Also inquiries and answers from the following:

B. M. Jr.—C. P. S.—J. E.—W. S. M.—J. L.—Z. & S.—W. C.—C. D.—W. M.—A. B. C.—R. K.—F. C. W.—N. Y.—B. D. W.—N. J.—F. C.—J. T. B.—R. C. N.—W. D.—J. McB. S.—E. T. D.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes galvanometers, and what do they cost? Who makes an economical rotary engine, and what is its cost? Who makes ice-making machinery? Who sells the best amateur printing press? Who sells barber's chairs? Who sells agricultural machinery? Who makes machines for tearing up tarred rope? Who sells the Gramme magneto-electric machine?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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DESIGNS PATENTED.

8,936.—FAN.—S. M. Dudley, Detroit, Mich.
8,937.—LOCKET.—G. W. Gill, Philadelphia, Pa.
8,938.—BADGE.—J. F. Naulty, Philadelphia, Pa.
8,939 to 8,941.—TOBACCO PIPES.—L. Nax, Phila., Pa.
8,942.—GLASS DISHES.—J. Proeger, Pittsburgh, Pa.
8,943.—CIGAR STAND.—W. E. Ryder, Sing Sing, N. Y.
8,944.—BREASTPINS, ETC.—C. T. Sloan, New York city.
8,945.—TYPE.—D. W. Bruce, New York city.
8,946.—CARD RECEIVER.—G. E. Hatch, East Cambridge, Mass.
8,947.—FURNACE BRICK.—G. H. Nott, Hyde Park, Mass.
8,948.—SADDLE CLIP.—M. Seward, New Haven, Conn.
8,949.—ARM CHAIRS.—M. Sulzbacher, New York city.
8,950.—ADVERTISING CARD.—J. P. Thomas, N. Y. city.
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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, January 28 to February 5, 1876.

5,632.—H. Varner, Montreal, P. Q. Fruit gatherer. Jan. 31, 1876.
5,633.—E. Bartlett, Renfrew, Ont. Machine for digging and picking potatoes. Jan. 31, 1876.
5,634.—B. and C. Hickox, Brantford, Ont. Breast iron. Jan. 31, 1876.
5,635.—P. Williams, Detroit, Mich., U. S. Wagon body and hay rack. Jan. 31, 1876.
5,636.—F. Bramer, Little Falls, N. Y., U. S. Wheel harrow. Jan. 31, 1876.
5,637.—F. S. Malloch, Brockville, Ont. Rounding and straightening metallic rods, etc. Feb. 2, 1876.
5,638.—L. and J. Gaffney, Osgoode, Ont., *et al.* Combination and burglar-proof lock. Feb. 2, 1876.
5,639.—A. J. Millikin, Smith's Falls, Ont. Shirt bosom. Feb. 5, 1876.
5,640.—C. E. Carpenter, Syracuse, N. Y., U. S. Side plaiter. Feb. 5, 1876.
5,641.—G. H. Little, Peabody, Mass., U. S. Injector and ejector. Feb. 5, 1876.
5,642.—C. A. Shaw, Boston, Mass., U. S. Nail-cutting machine. Feb. 5, 1876.
6,643.—J. L. Whiting, Boston, Mass., U. S. Making brush handles. Feb. 5, 1876.
5,644.—W. Pearson, Philadelphia, Pa., U. S. Hosiery-sewing machine, etc. Feb. 5, 1876.
5,645.—W. Vassie, Hamilton, Ont. Lamp holder for sewing machines. Feb. 5, 1876.
5,646.—P. K. Dederick, Albany, N. Y., U. S. Wire baling tie. Feb. 5, 1876.
5,647.—W. T. Nichols, Maywood, Ill., U. S. Road scraper. Feb. 5, 1876.
5,648.—E. D. Wright *et al.*, Springfield, Vt., U. S. Lamp chimney. Feb. 5, 1876.
5,649.—F. G. Farnham, Hawley, Pa., U. S. Glove fastener. Feb. 5, 1876.
5,650.—C. Corby, London, Ont. Nut lock. Feb. 5, 1875.
5,651.—W. T. Doremus, New York city, U. S. Chair base. Feb. 5, 1876.
5,652.—C. E. Patric, Springfield, Ohio, U. S. Grain drill and seeding machine. Feb. 5, 1876.
5,653.—E. Curtiss, Findley, Ohio, U. S. Cider mill. Feb. 5, 1876.
5,654.—H. Préfontaine, Montreal, P. Q. Hand blower. Feb. 5, 1876.
5,655.—E. Fisher, Kincardine, Ont. Machine for cutting boiler plate. Feb. 5, 1876.
5,656.—S. Warrick, Montreal, P. Q. Steam engine. Feb. 5, 1876
5,657.—A. J. Griffin, Lowell, Mass., U. S. Hydro-carbon burner and gas generator. Feb. 5, 1876.
5,658.—N. Seibert, San Francisco, Cal., U. S. Lubricator. Feb. 5, 1876.
5,659.—J. J. Hathinger, Hyde Park, Mass., U. S. Carpet sweeper. Feb. 5, 1876.
5,660.—J. L. Whiting, Boston, Mass., U. S. Making brushes. Feb. 5, 1876.
5,661.—H. Disston, Philadelphia, Pa., U. S. Hand saw and handle. Feb. 5, 1876.

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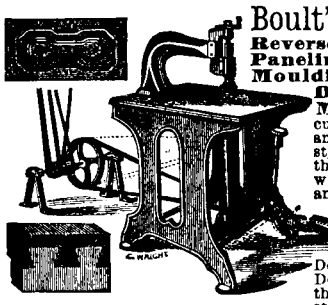

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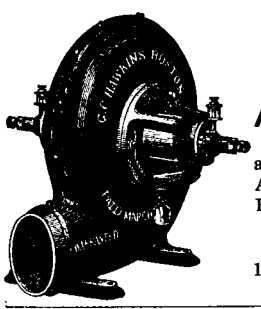

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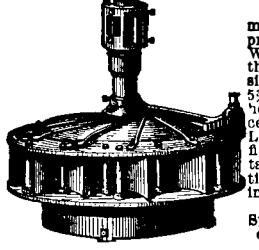

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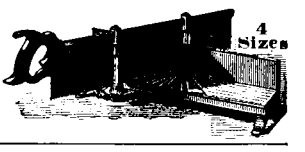

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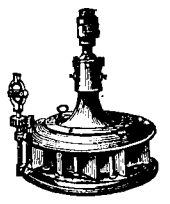

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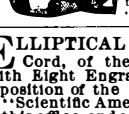

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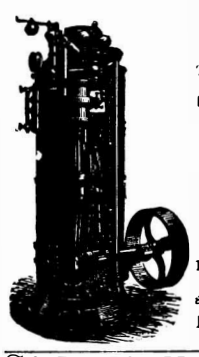

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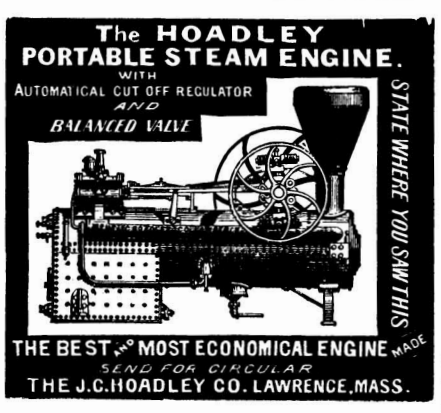

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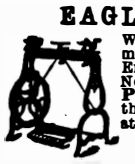

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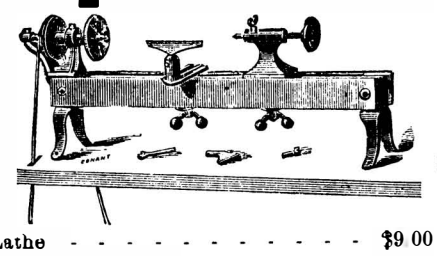

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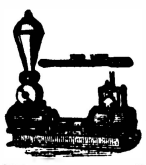

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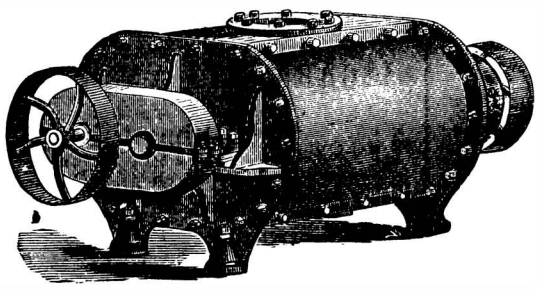

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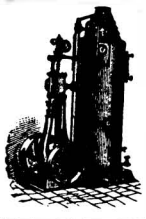

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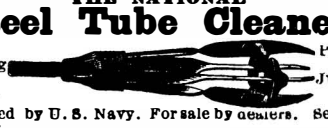

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